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BULLETIN OF THE SCHOOL OF EDUCATION
INDIANA UNIVERSITY

An Analysis of Arithmetic Textbooks (Fourth Period—1881 to 1910)

by

HENRY LESTER SMITH

and

MERRILL THOMAS EATON

A List of Bulletins in the Field of Education, Indiana University

by

KATHLEEN DUGDALE

Published by the
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Indiana University

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H.L.S. and M.T.E.

TABLE OF CONTENTS

PAGE

An Analysis of Arithmetic Textbooks (Fourth Period—1881 to 1910)

Introduction 5

General Description of the Textbooks Used 5

Essential Content 8

Arrangement of Content 9

The Question of Drill 11

The Use of Objects 12

The Use of Pictures 13

The Use of Practical Problems 14

Technique of Procedure 15

Results of the Analysis 16

Space Given to Each Topic 16

Space Given to Each Type of Content 26

Analysis of Problem Subjects 30

Sample Problems Showing Subject Matter 37

Practicality of the Written Problems 49

Summary and Conclusions 55

A List of Bulletins in the Field of Education, Indiana University .. 59

LIST OF TABLES

TABLE		PAGE
I.	Number of 400-Word Pages Given to Each Topic in Arithmetic Textbooks from 1881 to 1910	17
II.	Per Cent of 400-Word Pages Given to Each Topic in Arithmetic Textbooks from 1881 to 1910	21
III.	Major Topics in Order of Space Given to Each	26
IV.	Number of 400-Word Pages Given to Each Type of Content in Arithmetic Textbooks from 1881 to 1910	27
V.	Per Cent of 400-Word Pages Given to Each Type of Content in Arithmetic Textbooks from 1881 to 1910	28
VI.	Number of Words Used in Each of 13 Problem-Subject Fields and Total Number of Times These Words Are Used	30
VII.	Frequency of Mention of 83 of the Problem Subjects in Arithmetic Textbooks from 1881 to 1910	31
VIII.	Total Number and Average Number of Different Problem Subjects in Each Book	36

An Analysis of Arithmetic Textbooks (Fourth Period—1881 to 1910)

H. L. SMITH and M. T. EATON

INTRODUCTION

THIS bulletin contains the fourth part of the analysis being made of arithmetic textbooks published from 1706 to 1940, inclusive. The first three parts of the analysis, covering the periods 1706 to 1820, 1821 to 1850, and 1851 to 1880, have been published in earlier issues of the *Bulletin of the School of Education*, Indiana University (Vol. XVIII, nos. 1 and 6, 1942). The arithmetic texts analyzed in the present bulletin are a selection from those published during the fourth period, 1881 to 1910.

GENERAL DESCRIPTION OF THE TEXTBOOKS USED

The books selected to represent the books of the fourth period of the study include 13 sets of two books each, the first book in each series being elementary and the second advanced. The list is as follows:

37. White, E. E. *A New Elementary Arithmetic, Uniting Oral and Written Exercises.* Eclectic Educational Series. Van Antwerp, Bragg, and Co., New York, 1883.
A New Complete Arithmetic, Uniting Oral and Written Exercises. Eclectic Educational Series. Van Antwerp, Bragg, and Co., New York, 1883.
38. Indiana Educational Series. *Complete Arithmetic, Combining Oral and Written Exercises.* Indiana Schoolbook Co., Indianapolis, Indiana. Copyright 1886 by Standard Schoolbook Co.
Elementary Arithmetic, Combining Oral and Written Exercises. Indiana Schoolbook Co., Indianapolis, Indiana. Copyright 1886 by Standard Schoolbook Co.
39. Milne, William J. *Elements of Arithmetic, for Primary and Intermediate Classes in Public and Private Schools.* American Book Co., New York, 1893.
Standard Arithmetic, Embracing a Complete Course for Schools and Academies. American Book Co., New York, 1892.
40. Southworth, Gordon A. *The Essentials of Arithmetic, Oral and Written.* Book I, for Lower Grades. Thos. R. Shewell and Co., New York, 1893.
The Essentials of Arithmetic, Oral and Written. Book II, for Upper Grades. Thos. R. Shewell and Co., New York, 1895.
41. Walsh, John H. *Mathematics for Common Schools, Part I—A Primary Arithmetic.* D. C. Heath and Co., Publishers, Boston, 1898.
Mathematics for Common Schools, Part II—Grammar School Arithmetic. D. C. Heath and Co., Publishers, Boston, 1897.

42. McClellan, J. A. and Ames, A. F. *The Public School Arithmetic* (based on McClellan and Dewey's *Psychology of Numbers*). The Macmillan Co., New York, 1898.
The Primary Public School Arithmetic (based on McClellan and Dewey's *Psychology of Numbers*). The Macmillan Co., New York, 1898.
43. Indiana Schoolbook Company. *Indiana Elementary Arithmetic; being a special edition of A Primary Arithmetic by A. R. Hornbrook.* Indiana Schoolbook Co., Indianapolis, Indiana, 1899.
Indiana Advanced Arithmetic; being a special edition of American Comprehensive Arithmetic by M. A. Bailey. Indiana Schoolbook Co., Indianapolis, Indiana, 1899.
44. The Woodward Series. *Elementary Arithmetic.* By E. D. Luckey. Woodward and Tiernan Printing Co., St. Louis, 1899.
New Practical Arithmetic on the Objective Plan. By E. D. Luckey. Woodward and Tiernan Printing Co., St. Louis, 1899.
45. Hornbrook, Adelia R. *Grammar School Arithmetic.* American Book Co., New York, 1900.
A Primary Arithmetic; number studies for the second, third, and fourth grades. American Book Co., New York, 1898.
46. The Johnson Series. *School Arithmetic; primary book.* By John M. Colaw and J. K. Ellwood. B. F. Johnson Publishing Co., Richmond, Va., 1900.
School Arithmetic; advanced book. B. F. Johnson Publishing Co., Richmond, Va., 1900.
47. Southworth, Gordon A. and Stone, John C. *The Southworth-Stone Arithmetic; a rational method* (Book I, for Lower Grades). Benjamin H. Sanborn and Co., New York, 1904.
The Southworth-Stone Arithmetic; a rational method (Book II, for Higher Grades). Benjamin H. Sanborn and Co., New York, 1900.
48. Smith, D. E. *Grammar School Arithmetic.* Ginn and Co., Publishers, Boston, 1904.
Primary Arithmetic. Ginn and Co., Publishers, Boston, 1904.
49. Cook, John W. and Cropsey, N. *The New Advanced Arithmetic.* Silver, Burdett, and Co., New York, 1892.
The New Elementary Arithmetic. Silver, Burdett, and Co., New York, 1893.

In this analysis, the two books of each set are counted as one. The books are, as sets, quite uniform in general appearance and make-up. All sets except two are cloth bound. The two earliest series, White's, 1883, and the Indiana Educational series, 1886, are bound with a very thin leather. This indicates rather definitely that after 1886 it was not thought necessary or advisable to use leather in binding. In length of page, the books vary only a small amount. But in number of pages there is found a very considerable difference. In the group of advanced arithmetics, Walsh's book (41) has 642 printed pages, and the Johnson series has 442 printed pages, while Southworth's has only 262 pages and an appendix of 49 printed pages.

Twenty pages of the Johnson series, however, are devoted to algebra, a subject which is not found in any of the other books except Walsh's.

In size of page, the books, both primary and advanced, conform for the most part to a 3½ by 5⅝ common standard. Both the primary and advanced books by Southworth and by Southworth and Stone have a 4-inch line, while McClellan and Ames' advanced book (42) has a 3¾-inch line. With these exceptions the 13 sets are notably uniform.

The size of type used in the 13 series is almost the same throughout. There are two exceptions. Woodward's *Elementary Arithmetic* and Smith's *Primary Arithmetic* have a type which is larger and therefore more easily read. In all books the type is large enough and clear enough to make comparatively easy reading.

A careful survey of the prefaces and introductions of the 26 texts shows some rather interesting comparisons, many similarities, and a few contrasts.

The most interesting and somewhat amusing feature of the prefaces is the rather naïve way in which many of the authors seek to impress upon the public that they are presenting something newer and better than the material which older books contain. The methods of some authors are criticized by others as irrational and illogical, a waste of time and effort; the problems in other books are said to be impractical, are of little or no interest to students, or are too few or too many. One author boasts that the problems in his book are unsurpassed in variety and excellence; another that his problems are of the type that appeal to students and are replacing the artificial problems used in other books. Some authors admit that they are very discreet and wise in leaving out of their books some subjects which, though included in the run-of-mine arithmetics, are really nonessential.

In general it must be said that the changes made in methods, in arrangement of topics, or in content are very minor indeed. In most cases the texts follow the usual methods and include the usual content. In short, one is impressed by the fact that the students could swap texts in mid-stream and not know the difference, or be greatly hampered from the standpoint of "essential content"; but they might still be puzzled in trying to make sense out of many problems that are "preëminently practical" and "true to life," problems so unusual that "their practical character will be discerned by a very cursory examination."

Naturally there are some exceptions to the general rule. In a few cases there are definite changes made in arrangement of content or in methods of dealing with the content. In no case, however, is there a change that could be considered revolutionary; and in no case could it be truly claimed that a notable contribution has been made.

A most common element found in the prefaces, in some cases definitely mentioned and in others clearly sensed, is the feeling that the teaching of arithmetic and the arithmetic textbook situation were

in great need of improvement. Most of the authors felt that their books would meet a definite need and would help improve conditions.

In order to get a true picture of the ideas of the different authors and of their attitudes toward the current problems of content and methods in arithmetic, it is necessary to group their statements around certain subjects. The most common are: essential content; order and arrangement of content; the question of drill; the use of objects; the use of pictures; the use of practical problems.

Essential content—Quite naturally there was a considerable difference of opinion as to what content was essential in arithmetics of this period. Opinions on this subject probably differed because of differing notions as to the goal of education. For example, if the goal of education in mathematics is to prepare all students to meet successfully the common numerical problems of everyday life, then a certain content could be omitted as unessential; but if the goal of education in the field of mathematics is set as furnishing an equipment not only for meeting practical daily problems but also for handling "pure" mathematics and the higher courses given in colleges, then the content should be of a broader, more inclusive nature.

There was a difference of opinion also as to just what subjects were essential in the equipping of students to handle the so-called practical arithmetic problems of daily life. The following quotations are examples of these differing ideas.

Woodward (44) says: "Since arithmetic affects all so intimately, it is evident that the *Elementary Arithmetic*, beyond which 80 per cent of our children never advance, should deal with those phases of arithmetic which come nearest to us in our daily life. Not the schoolmaster's ways of manipulating numbers, but everybody's way of dealing with things, should be prominent."

But this author includes percentage, which Milne (39) leaves out, though Milne contends that "a student who goes no farther in his arithmetical studies than this will have a knowledge of the science, sufficient to enable him to perform, with accuracy and intelligence, most of the processes required in ordinary life." Woodward also includes ratio and proportion as a necessary subject, which, again, Milne omits as nonessential. On the other hand, Milne includes a section on aliquot parts, while Woodward does not consider this subject worthy of a place.

Hornbrook (45) provides another excellent example of this difference of opinion as to content when she states that "some subjects that have neither a practical nor a high disciplinary value, though found in many textbooks, are designedly omitted from this book," and yet she includes 25 pages on literal quantities and 15 pages on aliquot parts, two subjects which most authors omitted.

Again, Southworth and Stone (47) state: "Many subjects heretofore treated in arithmetics have been omitted as nonessential or beyond the legitimate work of the elementary schools." But these authors include almost everything usually admitted, except cube root.

It is quite evident from these illustrations that there was a lack

of unanimity of opinion as to what was essential in the field for a practical life.

Arrangement of content—On the question of arrangement of content and methods of presenting it there were also many different opinions. The two chief causes of contention seem to have been the so-called "spiral" and "topical" methods.

The "spiral" method as explained by different authors, e.g. Smith (48), is to present a certain subject, such as common fractions, and carry forward the study of that subject to a certain point, then go on to something else. After a time a return is made to the subject and it is carried forward for some distance again. Each time the work is a little more difficult, but in none of these periods of study is the subject completed. The method is not truly spiral, for that would be a continuous unbroken ascent to the highest point. The method as used, however, is an intermittent series of advancements, each treatment taking up the subject where the former study has been broken off.

Over against this spiral method of arrangement and treatment of the content is the method called "topical." Using the latter method, the practice is to arrange the content in a logical or a natural manner and then to handle each subject as a separate unit. Each unit is thoroughly treated and fully completed before another subject is introduced.

In the period under study, 1881 to 1910, there was evidently a reaction against each of these methods when it was used exclusively or carried to an extreme. It is evident, also, that the methods were being dropped and were by some authors considered out of date. Several authors mention the fact that they attempted to pursue a middle ground in order to avoid the evils inherent in either one when used alone. Southworth (40), for example, says: "The work to be done has been arranged not topically on the assumption that one subject is to be finished before even the elements of another one are begun, but in the order of study which prevails in the best schools."

Smith (48) in his primary book states that he is attempting, "in sequence of topic, to follow as closely as possible such recent courses of study as have been the most carefully prepared for our public school systems. The purely topical, the attempt to exhaust a subject, like common fractions, in a single chapter, is now obsolete in our leading schools, while the spiral method is scrappy, uninteresting, and lacking in the continuity so essential to thoroughness." Smith (48) is especially careful, in the preface to his advanced arithmetic, to point out that he has sought to follow a middle path. He says that "modern courses invariably suggest the repetition of the most important portions of arithmetic from time to time, but they favor a somewhat exhaustive treatment of each subject whenever it is under discussion. The extreme spiral systems, in which no topic is ever thoroughly treated at one time but each is repeated until the pupil wearies of it, is psychologically too unwarranted to be considered seriously. On the other hand, the old-time practice of presenting

important chapters but once is equally unscientific. Between these extremes lies the mean of the modern courses of study."

There was the feeling also on the part of some of the authors that the topical order found in so many arithmetics was not the natural order. The Johnson series (46) in the primary text says: "There is no topical arrangement in Nature. And 'Nature the dear old nurse' permits the order of the child's mental development to determine the arrangement of the material. This arrangement keeps interest alive. This book aims to follow the natural order as closely as may be, considering the conditions under which teachers are required to work."

In the advanced arithmetic text, however, the Johnson series uses the topical method, explaining that "the topical plan of treatment has in the main been adhered to as giving the best adaptation to a wider range of schools.

"In the Primary book the order of topics has not been preserved, but the subject matter has been presented in the order that has been found to be most helpful, most stimulating, and most practical, the arrangement being determined by the order of the child's mental development rather than by the logic of the topic itself."

The statement above, taken from the advanced text of the Johnson series, gives evidence of a tendency found among arithmetic textbook authors to suit their books to the general demand of schools rather than to follow what they themselves believed to be the best plan. If a plan is "most helpful, stimulating, and practical," and "there is no topical arrangement in Nature," why should a good psychological plan which works so well in the fourth or fifth grade be dropped in the sixth?

Another example of the tendency just mentioned is found in Southworth (40), in his primary book, when he says that "the present tendency to subordinate arithmetic to other studies is recognized, and hence some subjects, hitherto made prominent in textbooks, have been presented less fully, or altogether omitted." Smith (48) also admits that he has intended "to follow as closely as possible such of the recent courses of study as have been the most carefully prepared for our public school systems"; for, "however an author may feel as to details, he is in the main bound by the consensus of opinion as thus expressed."

Anyone who studies the statements of the authors of the series of arithmetic texts selected to represent the period from 1881 to 1910 may find plenty of evidence that there was little general agreement as to what order of content was "natural," "logical," or "topical." In the primary book of the Johnson series (50) is this statement: "Logical minds will note with pleasure the orderly arrangement of subjects. For instance, common fractions are treated after decimal fractions because the former are more difficult." But is it not psychological or "natural" as well as logical to put the less difficult subject first?

According to the Indiana Schoolbook series (43), "the divisions of arithmetic are presented in their natural order, integers, common

fractions, decimals, denominate numbers, and numbers expressed by letters, followed by applications to business and to various employments." White's (37) advanced arithmetic gives, as the second point in the "characteristics" of his book, "a practical union of oral and written exercises in a natural and philosophical system of instruction." But the order of content followed by these two authors, each purportedly following the "natural" order, is not at all the same. In the Indiana Schoolbook series (43) denominate numbers is followed by mensuration, while in White's text (37) denominate numbers is followed by literal quantities, proportion, and percentage.

The Indiana Schoolbook series (43) does break away from the usual order in handling the multiplication tables. The author claims that he is presenting the tables in "an unusual order, more economical of children's time and effort." The "Master Key" of numbers, 10, with its various multiples, is presented first; then the 2's as pairs; then the 3's, as illustrated by the yardstick; then the 4's, by quarts and gallons, pecks and bushels; then the 5's as part of 10; after the 5's the 11's; then the 9's, as a departure from the 10's on the other side from the 11's; the 8's were taught as combination of forms. Nothing is said about the 6's and 7's, perhaps because no *natural* method of teaching them had been discovered!

The question of drill—One question about which there was little serious difference of opinion is that of the amount of drill that is necessary in doing successful work in arithmetic. Most of the writers of this series of texts make some mention of the drill question. A very few enter into a discussion of the controversy. Most seem to take it for granted that a good deal of drill is customary and even necessary.

Cook and Cropsey (49), in their primary book, say that, "the present edition of the *New Elementary Arithmetic* will be found to differ from the earlier edition principally in an increase in the amount of drill work given upon the fundamental operations. This change, we believe, recognizes a tendency of present day arithmetic work which has the approval of the best authorities." And Southworth and Stone (47) state that "to secure skill and proficiency in the more important subjects, abundant exercises for drill and practice have been provided." Oral and written problems in great abundance are given in about equal proportions. White (37) is quite definite in his ideas on the subject. He points out that "the first 62 pages present a thorough drill with small numbers. These first lessons embody the more important principles of what is known as the 'Grube' method, but they are not carried to the extreme of useless repetition and mechanism."

A lack of proficiency among the grammar school graduates of this period, who either entered high school or went into the employ of business men, was so noticeable that the reasons for it were being diligently sought out. Walsh (41) seemed to think he had found one cause for it in the lack of thorough drill and review. He says in his advanced arithmetic text: "Believing that there is some foundation for the complaints frequently made by business men and high school teachers that grammar school graduates are too often slow

and inaccurate in ordinary computations, the author has furnished throughout the entire work systematic drills and reviews in the addition, subtraction, multiplication, and division of ordinary numbers and of fractions." Milne (39) puts it rather bluntly when he says that "by going over the same lesson frequently the pupil will become familiar with numbers. Success in arithmetical processes is dependent to a large degree upon constant drill."

There is a note of warning, however, sounded by a few authors who felt that repetition or drill might be overdone. They saw the danger in mere repetition without enthusiasm or proper motivation. In the Indiana Educational series (38), Blythe points out that "progress comes more from properly graded new matter than from wearisome repetition. Growth is the result not of repetitions but of additions; hence space and time are not devoted to such repetitions."

Southworth (40) is in harmony with this point of view, for he argues that "it has been shown that principles and methods cannot be securely fixed by mere repetition, or the working of many examples. Fewer problems, if solved independently and logically analyzed, will do most toward attaining the highest purpose of arithmetical work."

The use of objects—With regard to the question of the use of objects in the teaching of arithmetic, the authors of the 13 sets of arithmetics are in fair accord. Some do not mention the subject, but a survey of their books shows that they made use of objects and pictures of objects in their problems. For example, White's (37) primary text has many pictures of objects, animals, and people, and most of his problems involve some kind of object. The Indiana Educational series (38) also fails to mention the use of objects but does remark that pictures are discarded because they divert attention and afford little help. This book, a contemporary of White's, uses very few objects even as a basis for problems. The author's viewpoint on use of pictures probably reflects also his viewpoint on the use of objects in number work.

Many of the authors, however, were definitely in favor of the use of objects. Some even suggest certain objects as practical for the purpose, and recommend that these be furnished by the school. For example, Cook and Cropsey (49) point out that "objective work is a very necessary means. All tables of measure should be learned by the aid of objects of standard measure, such as the yard, the quart, the ounce, and the gallon. These . . . should form a part of the regular school supplies." Milne (39) also suggests that "the examples should at first be given in connection with objects which can be conveniently obtained. From these the transition is easy to concrete examples in which the splints, or counters, or buttons, or beans, stand for other units."

Some of those who favored the use of objects in learning numbers felt it necessary to explain their position, just as Milne does in the preceding quotation. The Johnson series (46) says "children are taught to count by counting *something*. Ample provision is made for handwork, sense work, sense training, imaging, and expression. There is abundance of concrete work and graphic illustration."

A variation is furnished by Hornbrook (45), who believed that "number tables" could be used "as a concrete basis for the child's thinking while he is getting his first ideas of the facts of addition and multiplication tables. . . . The five columns of numbers are as concrete to them as five sticks."

In the minds of a few authors among the 13 there was some concern about the overuse of objects and about the possibility that using concrete objects might interfere with the development of ability to use numbers in the abstract. There was the question whether, if the use of objects were long continued, the mind might not be hobbled and restricted by the concrete. The Johnson series (46), for example, says that "primary number teaching must be begun by the pupil's observing and handling objects, yet the mere presence of the concrete does not guarantee the presence of definite numerical ideas in the mind of the pupil. . . . Cubes, splints, foot-rules, quart measures, . . . can be provided easily. How long their use should be continued . . . must be determined by the teacher." Southworth (40) also believes that "objects should be used until clear ideas of numbers, processes, and principles are obtained. The purpose of teaching, however, is to enable the pupil to think without objects. This purpose accomplished, their use should be discontinued."

Woodward (44) in a note to teachers is perhaps the most definite of the 13 authors in his statements about the necessity of using objects. "The pupil," he says, "should get his facts through experience; that is, he should get every fact by counting and combining small objects. Make each combination fall within the pupil's experience before he memorizes it."

The important question is "Is this the proper philosophy or psychology of mathematics?"

Evidently similar questions were in the mind of Cook (49). While he did not openly oppose the use of objects, he nevertheless believed that stress should be laid upon a thorough learning of fundamental operations. He says that "the tables of the fundamental operations must be learned so thoroughly that their application can be made without much conscious thought. To this end much of the work in elementary arithmetic should be *abstract* and with rather large numbers."

The use of pictures—In regard to the question of the use of pictures in number work little discussion is found. There was evidently little controversy over the subject during the 1881 to 1910 period. Only a few authors speak of the use of pictures, though one uses pictures without discussing the matter pro or con. One author, Blythe (Indiana Educational series), definitely opposes the use of pictures. "Pictures," he says, "are discarded because they divert attention and afford little aid in grasping arithmetical ideas."

Though White (37) in his primary book does not discuss pictures, he nevertheless has included at least one picture for every lesson with the exception of the thirteenth and fourteenth.

Smith (48) in his primary book suggests some reasons for using pictures. He recognizes the legitimate use of pictures for the follow-

ing purposes: to show the relations of numbers, to make real their use in measurements, to suggest materials for the use of teachers, to render more interesting and genuine the various groups of problems, and incidentally to present a page that shall attract children without allowing the book to become a collection of pictures." In his advanced book, also, the same author says that "pictures aid in the understanding of certain number relations." The Cook and Cropsey series (49) is the only one that speaks of the method to follow in using pictures: "Let the problem be pictured and let this picture be followed with the expression in figures before any formal expression in words is attempted. The object in picturing problems is not to teach children to make pictures . . . but to give a method of representation by which they can make their thought clear to themselves."

The use of practical problems—A final subject, in which nearly all of the authors were interested and about which many expressed an opinion, is that of the practicality of the contents of their own arithmetic books. Naturally there would be a great interest in this feature because the practical element in the problems would affect both the volume of sales and the popularity of the books. It would seem from their statements that most authors believed that the books written prior to their own had been impractical as well as poorly organized.

Woodward (44), for example, claims that "mere methods must give place to systematic treatment and a well-matured plan must replace the aimless arrangement of most books on numbers." He also states that his advanced book "is a practical arithmetic, because it aims at presenting such facts as will make learners proficient in doing . . . based on experience not on abstractions."

Smith (48) is rather critical of the problems found in the ordinary arithmetic texts of his day. In writing his primary books he was careful "in the selection of problems, to replace the artificial ones, against which teachers have so long protested, by those which appeal to the interests and needs of children in the primary grades." And in his advanced book he is just as determined "in the selection of problems to touch the actual life of this country at this time; to give correct ideas of the business customs of today, . . . to touch the genuine interests of pupils in the story of our natural resources and industries."

One of the problems of the elementary schools in all the periods studied was that of pupil mortality. Our modern compulsory school laws did not exist and a large percentage of pupils left school without finishing the eight grades. It was because of this fact that authors felt the need for arithmetics that would give pupils a practical knowledge of number processes that would fit them for meeting the common life situations where arithmetical problems would be involved, even though they dropped out of school before reaching the eighth grade. This was a difficult problem for authors of arithmetic textbooks who had in mind the satisfying of a public need. Different authors felt that they were making a contribution to the welfare of youth. Southworth (40), for example, says: "It is believed that this book will also secure such a practical knowledge of numbers as will meet the future requirements of the less fortunate whose circumstances may compel

them to leave school earlier." Woodward (44) says that "something more practical than what exists is needed" and asks, "Can that better thing be obtained?" The author of the Indiana Educational series points out that "in the preparation of the complete arithmetic, practical or business methods have received unusual attention. Those portions designed to qualify pupils for the actual business of life are amply treated and made clear."

It would be difficult to find a more boastful preface to a book than that in the Johnson series (46) which claims that "this book is unsurpassed in the variety and excellence of its problems. Many of the problems have the rare virtue of everyday utility. There are no absurd premises. The facts and figures are from authoritative sources, and include much information of practical value." The reader would naturally inquire why should not *all* instead of *many* of the problems have the rare virtue of everyday utility.

Some of these so-called practical problems will be scrutinized in a later section of this study.

It may be said, in summary, that the authors of arithmetic texts of the period from 1881 to 1910 were sincerely and diligently seeking to understand the current problems in the teaching and learning of arithmetic and that they earnestly attempted to adapt the methods and content of their texts to the actual needs of the schools. Although in this bulletin we may be able to set forth by tables the content of the texts, both as to the subjects treated and as to the type of material used in problems, nevertheless the actual amount of success the authors attained in meeting the life needs of the pupils will always be largely a matter of personal opinion.

TECHNIQUE OF PROCEDURE

In the first bulletin of this series (Vol. XVIII, No. 1) on the quantitative-qualitative analysis of arithmetic textbooks, the technique to be used in the analysis of the content of the books was given in detail. It is necessary, therefore, in this fourth study of the series to give only a general statement of the procedure followed.

In order to get complete pictures of the texts for purposes of comparison, a careful analysis was first made of the introductions and prefaces. This revealed, in part at least, the authors' purposes in writing the texts, their basic pedagogical theories, their attempted improvements, and their teaching methods. Second, a detailed analysis was made of the lesson content of each text. Page by page the specific subjects and types of content, and the amount of space given to each, were recorded on separate cards. The unit of measurement was five-hundredths of a page of the particular book being analyzed. The measurements were made comparable by translation into terms of a standard 400-word page.

The cards were first sorted according to subject content and a table set up showing the amount of space given by the 13 different authors to the various subjects dealt with in the texts.

Still another step was necessary to get a true picture of the

content of the texts. The data given in Table I had to be translated into terms of per cent, since the books were of different lengths. It is more important to know the *relative* amount of space given to a particular topic than to know the *actual* amount. If, for example, in a 200-page book 10 pages are given to decimals, that would mean 5 per cent of the book is given to that subject; if in a book of 300 pages the same amount (10 pages) is given to decimals, only 3 1/3 per cent of the book would be given to the subject. Table II therefore gives the data of Table I in *relative amounts* of space given to different subjects.

Further light was thrown on the problem by a second type of classification, shown in Table IV. Using the same cards, the contents were grouped according to general types of content irrespective of the topics treated. Examples of these types of content are: rules and principles, definitions, drill and written problems, and explanations.

Table V was set up to show the data given in Table IV in terms of per cent for the same reason as was given in connection with Table II.

RESULTS OF THE ANALYSIS

Space given to each topic—In Tables I and II there is furnished a complete picture of the number of 400-word pages and the per cent of total space which each author of the 13 sets of arithmetics devoted to particular subjects. These subjects are shown under 32 major classifications and 44 subdivisions. Some of the major classifications found in the period before this (1851-1880) are not found in the 1881-1910 period; for example, barter; tare, trett, and cloff; mechanics; and building association business. Some new general classifications appear, such as stocks, properties of numbers, the metric system, and cancellation. A new subtopic, equated payments, appears under percentage.

The number of 400-word pages found in the 13 different series varies from 581 in the Indiana Schoolbook series (43) to 895 in the Southworth-Stone series (47). The extra 314 pages in the Southworth-Stone books are devoted chiefly to a much fuller treatment of a few subjects. For example, 109 pages are given to percentage as compared with 55 in the Indiana Schoolbook series; 51 pages are given to decimals as compared with 20; and 119 pages are given to fractions as compared with 52.

The "Big Ten" of the 32 subjects treated are given 7,991 pages out of the total of 9,272 contained in all books combined. In terms of percentage, 30 per cent of the subjects treated in all texts are given over 86 per cent of the total space. They are treated in every text with one exception: Geometric forms are not included in the Indiana Educational series (38).

Several subjects included in Tables I and II have been presented by only one to three authors. For example, alligation, double partnership, duo-decimals, foreign money, and perpetuities and annuities are each included by only one author; analysis, aliquot parts of fractions, and imports and exports are each treated by only two authors; aliquot

TABLE I. NUMBER OF 400-WORD PAGES GIVEN TO EACH TOPIC IN ARITHMETIC TEXTBOOKS FROM 1881 TO 1910

Topic	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Smith series	Cook-Cropsey series	Total pages
	37	38	39	40	41	42	43	44	45	46	47	48	49	
Algebra	0	0	0	42.11	70.40	0	0	0	39.18	33.79	4.41	5.57	12.92	208.38
Aliquot parts	0	0	0	0	0	0	0	0	15.36	1.86	0	1.63	0	18.85
Alligation	0	0	0	0	0	0	0	7.21	0	0	0	0	0	7.21
Analysis	9.72	0	.29	0	0	0	0	0	0	0	0	0	0	10.01
Arithmetic	2.09	13.52	1.67	0	0	0	0	0	0	0	0	0	0	17.28
Bills and accounts	.79	6.25	4.42	9.01	4.20	3.77	8.60	3.22	1.25	3.64	11.25	12.16	11.63	80.19
Bonds	1.08	0	0	1.58	0	0	0	0	7.13	0	2.79	0	2.89	15.47
Cancellation	0	9.70	7.98	1.82	3.99	0	0	2.30	2.21	2.02	.66	2.18	0	32.86
Compound denominate numbers —general	18.14	41.01	29.36	4.98	8.77	30.88	43.26	16.66	19.18	42.01	7.79	24.74	7.90	
Addition	4.32	2.94	1.09	0	1.16	1.69	0	5.95	6.03	2.71	.14	.97	2.81	
Division	1.08	1.62	3.55	0	2.10	1.04	0	15.68	2.35	2.09	.14	3.27	0	
Multiplication	1.08	2.35	2.10	0	0	.78	1.36	4.20	6.03	.85	.22	1.57	2.36	
Subtraction	2.09	4.56	3.92	0	.44	1.30	0	3.15	6.62	2.56	.37	2.06	0	
Reduction	24.85	14.33	23.13	0	.73	13.06	0	17.71	12.57	1.94	1.47	5.75	3.12	
Total	52.06	66.81	63.15	4.98	13.20	48.75	44.62	63.35	52.78	52.16	10.13	38.36	16.19	526.54

TABLE I—CONTINUED

Topic	37	38	39	40	41	42	43	44	45	46	47	48	49	Total pages
Decimals—general	22.96	12.27	18.56	24.88	6.16	7.54	16.84	18.62	7.28	11.39	27.64	10.95	21.13	
Addition	2.81	4.63	4.42	2.51	1.67	3.71	.53	5.39	2.94	4.10	3.38	5.02	2.66	
Division	7.42	3.38	8.05	2.12	5.08	10.79	1.51	5.53	7.28	1.71	6.84	3.57	8.28	
Multiplication	4.54	4.05	6.82	5.81	2.18	8.78	.83	3.85	7.57	8.14	12.27	8.17	.84	
Subtraction	2.52	3.23	3.70	.86	.87	3.19	.30	1.05	4.63	0	1.32	.48	10.94	
Duo-decimals	1.44	0	0	0	0	0	0	0	0	0	0	0	0	
Total	41.69	27.56	41.55	36.18	15.96	34.01	20.01	34.44	29.70	25.34	51.45	28.19	43.85	429.93
Duties and customs	2.16	2.06	0	2.28	0	.52	0	3.85	0	0	0	0	0	10.87
Federal money	30.17	13.74	2.39	14.68	14.79	19.31	3.62	0	17.35	13.18	15.66	7.08	5.40	157.37
Foreign and domestic exchange	10.15	7.94	9.28	6.36	6.89	3.06	9.21	0	0	6.67	6.62	9.32	6.84	82.34
Foreign money	0	2.43	0	0	0	0	0	0	0	0	0	0	0	2.43
Fractions (common)—general	29.66	28.59	62.35	56.96	22.26	33.67	23.93	0	70.05	29.98	75.62	31.04	46.97	
Addition	5.26	14.77	8.48	4.50	17.26	9.42	1.81	0	3.53	2.64	.44	2.24	0	
Addition and subtraction	1.30	0	0	0	9.43	6.31	4.00	14.49	11.39	1.85	6.62	5.26	6.46	
Aliquot parts	0	2.43	4.50	0	0	0	0	0	0	0	0	0	0	
Division	9.14	10.22	25.66	15.25	6.02	6.76	7.02	0	12.86	8.22	20.65	7.93	13.45	
Multiplication	9.43	18.89	15.23	11.69	7.75	7.80	3.25	11.97	26.02	0	9.99	11.13	17.63	
Multiplication and division	0	0	0	0	2.90	.39	4.68	0	.44	10.62	.74	0	.30	
Subtraction	4.90	7.64	8.05	2.37	12.10	3.25	1.51	11.34	8.60	2.95	.15	2.36	7.68	
Complex fractions	6.41	1.10	.65	0	0	0	.15	0	1.54	.16	1.18	0	0	
Reduction	0	0	0	0	0	0	6.42	0	0	0	4.34	8.89	0	
Total	66.10	83.64	124.92	90.77	77.72	67.60	52.77	37.80	134.43	56.42	119.73	68.85	92.49	1,073.24
Fundamental processes in whole numbers—general	0	0	46.61	20.85	61.68	0	13.59	28.35	4.33	19.14	48.00	14.28	46.88	
Addition	23.97	43.30	40.82	16.59	25.73	55.05	31.71	27.23	49.91	44.56	22.05	30.43	22.80	
Addition and subtraction	17.21	0	6.74	1.03	10.66	12.86	11.33	7.14	12.20	82.69	13.45	3.09	13.90	
Division	29.88	44.39	48.65	27.41	30.09	31.27	26.57	27.02	28.67	34.95	24.62	31.52	24.06	
Multiplication	28.38	45.20	47.49	21.73	32.70	55.32	40.02	22.47	32.93	38.36	42.70	42.77	40.50	

TABLE I—CONTINUED

Multiplication and division	18.65	0	.87	29.31	2.54	12.68	0	5.18	8.09	11.32	29.69	2.36	28.58	
Subtraction	17.21	35.35	30.45	23.86	10.15	0	21.66	16.24	22.56	29.37	17.35	21.78	17.86	
Total	135.30	168.24	221.63	140.78	173.55	167.18	144.88	133.63	158.69	260.39	197.86	146.23	194.58	2,242.94
Geometry—														
Geometric forms	5.18	0	12.54	18.01	75.40	3.71	31.33	12.60	66.88	28.44	30.43	10.04	.30	
Area	18.08	0	10.01	41.87	8.27	12.67	13.74	15.96	35.72	2.95	52.04	29.10	1.90	
Volumes	11.23	0	6.31	0	9.20	2.28	3.55	3.92	4.34	.62	21.83	6.11	4.10	
Total	34.49	0	28.86	59.88	92.87	18.66	48.62	32.48	106.94	32.01	104.30	45.25	6.30	610.66
Imports and exports	0	0	0	0	0	0	0	0	0	0	2.21	0	1.98	4.19
Longitude and time	6.91	2.94	4.86	.87	6.45	4.88	2.04	7.21	7.79	1.16	3.97	7.80	3.12	60.00
Measures, tables, and area	12.46	12.13	18.56	20.78	38.14	31.01	10.04	35.14	7.50	19.53	36.82	41.02	114.00	397.13
Metric system	13.32	5.44	6.38	5.93	2.32	14.24	20.23	0	1.91	6.43	8.09	4.66	7.68	96.63
Numeration—														
Notation—general	32.76	19.85	32.99	8.37	0	0	26.20	13.09	0	32.63	18.89	17.42	16.04	
By words and Arabic symbols	0	0	10.08	0	13.99	26.19	2.26	0	0	0	0	0	0	
By Roman numerals	0	1.69	3.92	2.69	1.74	4.23	4.53	1.61	41.23	0	0	0	1.90	
Total	32.76	21.54	46.99	11.06	15.73	30.42	32.99	14.70	41.23	32.63	18.89	17.42	17.94	334.30
Partnership—general	4.18	4.19	6.74	0	.73	0	0	0	0	0	0	2.24	0	
Single	0	0	0	0	0	1.82	0	7.84	0	3.26	0	0	0	
Double	0	0	0	0	0	2.99	0	0	0	0	0	0	0	
Total	4.18	4.19	6.74	0	.73	4.81	0	7.84	0	3.26	0	2.24	0	33.99
Percentage—general	13.82	0	18.63	22.67	9.06	47.51	19.33	13.93	48.08	33.94	39.84	43.92	0	
Commission and brokerage	0	4.41	3.47	7.82	0	4.68	2.27	9.87	3.68	3.41	8.52	3.09	8.82	
Discount	12.67	6.10	1.89	13.59	7.25	9.88	4.53	11.06	9.63	15.73	13.68	9.98	13.83	
Insurance	1.30	2.13	4.28	3.08	0	3.50	1.36	13.23	6.10	2.32	2.86	3.39	2.96	
Interest—general	24.41	0	39.66	34.21	0	0	2.15	21.00	2.57	1.39	0	0	0	
Compound	0	2.43	6.02	2.61	1.01	3.83	4.53	2.10	0	1.70	2.50	16.88	2.89	
Equated payment	12.09	10.44	7.76	4.74	0	0	1.74	10.64	0	9.07	0	0	0	

TABLE I—CONTINUED

	37	38	39	40	41	42	43	44	45	46	47	48	49	Total pages
Partial payment	5.54	4.56	4.06	10.11	6.45	4.48	1.43	1.96	4.11	1.70	0	0	0	
Simple	0	31.61	0	0	14.55	12.29	16.31	0	11.76	13.72	26.68	0	39.06	
Notes	4.54	4.11	0	6.79	1.16	0	1.66	2.10	4.26	2.33	15.80	3.57	15.89	
Perpetuities and annuities	0	0	0	0	0	0	0	4.13	0	0	0	0	0	
Profit and loss	15.34	3.23	8.34	3.56	4.57	5.79	.60	21.28	2.64	6.66	0	5.86	0	
Total percentage	89.71	69.02	94.11	109.18	44.15	91.96	55.64	111.30	92.83	91.99	109.88	86.69	83.45	1,129.91
Powers and roots—general	2.45	0	0	2.29	0	1.17	0	1.47	0	4.26	0	0	0	
Involution	0	1.03	3.41	1.03	0	1.82	.83	0	12.05	1.24	0	0	10.56	
Evolution	18.65	13.67	21.31	11.53	4.86	15.41	10.95	11.41	10.88	10.70	16.83	0	17.56	
Total	21.10	14.70	24.72	14.85	4.86	18.40	11.78	12.88	22.93	16.20	16.83	0	28.12	207.37
Progression—														
Arithmetical	.43	2.94	3.77	0	0	0	0	7.07	0	0	0	0	0	
Geometrical	2.23	1.98	2.90	0	0	0	0	0	0	0	0	0	0	
Total	2.66	4.92	6.67	0	0	0	0	7.07	0	0	0	0	0	21.32
Properties of numbers	19.44	21.02	19.57	6.32	5.36	19.11	21.14	15.61	32.78	7.52	6.03	6.29	25.76	205.95
Ratio and proportion	13.25	10.66	16.02	7.19	4.49	26.33	44.99	19.95	31.38	15.11	29.55	12.04	16.57	247.53
Stocks	5.33	1.10	9.86	3.63	1.74	9.95	10.12	13.23	7.86	5.81	8.53	5.93	8.74	91.83
Taxes	3.31	2.35	3.62	1.90	1.45	2.47	1.36	4.62	8.01	4.11	2.87	5.57	2.96	44.60
Miscellaneous problems	29.59	56.82	54.38	101.44	57.86	46.73	33.60	37.31	62.93	11.94	114.15	82.04	115.82	804.61
Other miscellaneous items	10.01	0	0	7.66	0	2.34	4.91	22.75	1.84	4.19	12.64	0	0	66.34
Total 400-word pages	649.83	628.72	818.62	701.24	656.85	665.51	581.17	627.89	884.00	707.36	895.32	636.52	819.23	9,272.26

TABLE II. PER CENT OF 400-WORD PAGES GIVEN TO EACH TOPIC IN ARITHMETIC TEXTBOOKS FROM 1881 TO 1910

Topic	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Smith series	Cook-Cropsey series	Total per cent
	37	38	39	40	41	42	43	44	45	46	47	48	49	
Algebra	0	0	0	6.13	10.71	0	0	0	4.43	4.78	.49	.88	1.58	2.25
Aliquot parts	0	0	0	0	0	0	0	0	1.74	.26	0	.26	0	.20
Alligation	0	0	0	0	0	0	0	1.15	0	0	0	0	0	.08
Analysis	1.50	0	.04	0	0	0	0	0	0	0	0	0	0	.11
Arithmetic	.32	2.15	.20	0	0	0	0	0	0	0	0	0	0	.19
Bills and accounts	.12	.99	.54	1.31	.64	.57	1.56	.51	.14	.51	1.26	1.91	1.42	.86
Bonds	.17	0	0	.23	0	0	0	0	.81	0	.31	0	.35	.17
Cancellation	0	1.54	.97	.26	.61	0	0	.37	.25	.29	.07	.34	0	.35
Compound denominate numbers—														
general	2.79	6.52	3.56	.73	1.33	4.64	7.88	2.65	2.17	5.94	.87	3.89	.96	
Addition	.74	.47	.13	0	.19	.25	0	.95	.68	.38	.02	.15	.34	
Division	.16	.26	.43	0	.32	.16	0	2.50	.27	.30	.02	.51	0	
Multiplication	.16	.37	.26	0	0	.12	.25	.67	.68	.12	.03	.24	.29	
Subtraction	.32	.72	.48	0	.07	.20	0	.50	.75	.36	.04	.32	0	
Reduction	3.82	2.28	2.82	0	.11	1.96	0	2.82	1.42	.27	.16	.90	.38	
Total	7.97	10.63	7.72	.73	2.01	7.33	8.12	10.09	5.97	7.37	1.13	6.03	1.98	5.68

TABLE II—CONTINUED

Topic	37	38	39	40	41	42	43	44	45	46	47	48	49	Total per cent
Decimals—general	3.53	1.95	2.27	3.62	.94	1.13	3.07	2.97	.82	1.61	3.09	1.72	2.58	
Addition	.43	.74	.54	.36	.25	.56	.10	.86	.33	.58	.38	.79	.32	
Division	1.14	.54	.98	.31	.77	1.62	.27	.88	.82	.24	.76	.56	1.01	
Multiplication	.70	.64	.83	.85	.33	1.32	.15	.61	.86	1.15	1.37	1.28	.10	
Subtraction	.39	.51	.45	.12	.13	.48	.05	.17	.52	0	.15	.08	1.34	
Duo-decimals	.22	0	0	0	0	0	0	0	0	0	0	0	0	
Total	6.41	4.38	5.07	5.27	2.42	5.11	3.65	5.48	3.36	3.58	5.75	4.43	5.35	4.64
Duties and customs	.33	.33	0	.33	0	.08	0	.61	0	0	0	0	0	.12
Federal money	4.64	2.18	.29	2.14	2.25	2.90	.66	0	1.96	1.86	1.75	1.11	.66	1.70
Foreign and domestic exchange	1.56	1.26	1.33	.93	1.04	.46	1.68	0	0	.94	.74	1.46	.83	.89
Foreign money	0	.39	0	0	0	0	0	0	0	0	0	0	0	.03
Fractions (common)—general	4.56	4.55	7.62	8.30	3.38	5.06	4.36	0	7.93	4.24	8.45	4.88	5.73	
Addition	.81	2.35	1.04	.66	2.63	1.42	.33	0	.40	.37	.05	.35	0	
Addition and subtraction	.20	0	0	0	1.43	.95	.73	2.30	1.29	.26	.74	.83	.79	
Aliquot parts	0	.39	.55	0	0	0	0	0	0	0	0	0	0	
Division	1.41	1.63	3.13	2.22	.91	1.02	1.27	0	1.46	1.16	2.31	1.25	1.64	
Multiplication	1.45	3.00	1.86	1.70	1.18	1.17	.59	1.91	2.94	0	1.12	1.75	2.15	
Multiplication and division	0	0	0	0	.43	.06	.85	0	.30	1.50	.08	0	.04	
Subtraction	.75	1.21	.98	.34	1.84	.49	.27	1.81	.97	.52	.02	.37	.94	
Complex fractions	.99	.18	.08	0	0	0	.03	0	.17	.02	.13	0	0	
Reduction	0	0	0	0	0	0	1.17	0	0	0	.48	1.40	0	
Total	10.17	13.30	15.26	13.23	11.83	10.15	9.61	6.02	15.21	7.98	13.37	10.82	11.29	11.57
Fundamental processes in whole numbers—general	0	0	5.69	3.04	9.39	0	2.48	4.56	.49	2.71	5.36	2.24	5.72	
Addition	3.69	6.89	4.98	2.42	3.92	8.27	5.78	4.34	5.65	6.30	2.46	4.78	2.78	
Addition and subtraction	2.65	0	.82	.15	1.62	1.93	2.07	1.14	1.38	11.69	1.50	.49	1.70	
Division	4.60	7.06	5.94	3.99	4.58	4.70	4.84	4.30	3.24	4.94	2.75	4.95	2.94	
Multiplication	4.32	7.19	5.82	3.17	4.98	8.31	7.29	3.58	3.73	5.42	4.77	6.72	4.94	

TABLE II—CONTINUED

Multiplication and division	2.87	0	.11	4.27	.38	1.91	0	.82	.92	1.60	3.32	.37	3.49	
Subtraction	2.65	5.62	3.72	3.48	1.46	0	3.95	2.59	2.55	4.15	1.94	3.42	2.18	
Total	20.83	26.76	27.09	20.52	26.42	25.12	26.40	21.28	17.95	36.81	22.10	22.97	23.75	24.19
Geometry—														
Geometric forms	.80	0	1.53	2.62	11.33	.56	5.71	2.01	7.57	4.02	3.40	1.58	.04	
Area	2.78	0	1.22	6.10	1.26	1.90	2.50	2.54	4.04	.42	5.81	4.57	.12	
Volumes	1.73	0	.77	0	1.40	.34	.65	.62	.49	.09	2.44	.96	.50	
Total	5.31	0	3.52	8.73	14.13	2.80	8.86	5.17	12.10	4.53	11.65	7.11	.77	6.59
Imports and exports	0	0	0	0	0	0	0	0	0	0	.25	0	.24	.05
Longitude and time	1.06	.47	.59	.13	.98	.73	.37	1.15	.88	.16	.44	1.23	.38	.65
Measures, tables, and area	1.91	1.93	2.26	3.03	5.81	4.66	1.83	5.60	.85	2.76	4.11	6.45	13.91	4.28
Metric system	2.05	.86	.78	.86	.21	2.14	3.69	0	.22	.91	.90	.73	.94	1.04
Numeration—														
Notation—general	5.04	3.15	4.03	1.22	2.13	0	4.77	2.08	0	4.61	2.11	2.74	1.96	
By words and Arabic symbols	0	0	1.23	0	0	3.94	.41	0	0	0	0	0	0	
By Roman numerals	0	.27	.58	.39	.27	.64	.82	.26	4.67	0	0	0	.23	
Total	5.04	3.43	5.74	1.61	2.39	4.57	6.01	2.34	4.67	4.61	2.11	2.74	2.19	3.61
Partnership—general	.64	.67	.82	0	.11	0	0	0	0	0	0	.35	0	
Single	0	0	0	0	0	.27	0	1.25	0	.46	0	0	0	
Double	0	0	0	0	0	.45	0	0	0	0	0	0	0	
Total	.64	.67	.82	0	.11	.72	0	1.25	0	.46	0	.35	0	.37
Percentage—general	2.13	0	2.28	3.30	1.38	7.14	3.52	2.22	5.44	4.80	4.45	6.90	0	
Commission and brokerage	0	.70	.42	1.14	0	.70	.41	1.57	.42	.48	.95	.49	1.08	
Discount	1.95	.97	.23	1.98	1.10	1.48	.83	1.76	1.09	2.22	1.53	1.57	1.69	
Insurance	.20	.34	.52	.45	0	.53	.24	2.11	.69	.33	.32	.53	.36	
Interest—general	3.75	0	4.84	4.99	0	0	.39	3.35	.29	.20	0	0	0	
Compound	0	.38	.74	.38	.15	.58	.81	.33	0	.24	.28	0	.35	
Equated payment	1.86	1.66	.95	.69	0	0	.32	1.69	0	1.28	0	2.65	0	

TABLE II—CONTINUED

Topic	37	38	39	40	41	42	43	44	45	46	47	48	49	Total per cent
Partial payment	.85	.72	.49	1.47	.98	.67	.26	.31	.47	.24	0	0	0	
Simple	0	5.03	0	0	1.77	1.85	2.97	0	1.33	1.94	2.98	0	4.77	
Notes	.70	.65	0	.99	.17	0	.30	.33	.48	.33	1.76	.56	1.94	
Perpetuities and annuities	0	0	0	0	0	0	0	.66	0	0	0	0	0	
Profit and loss	2.36	.51	1.02	.51	.69	.87	.11	3.39	.30	.94	0	.92	0	
Total	13.81	10.97	11.50	15.11	6.72	13.82	10.14	17.73	10.50	13.00	12.27	13.62	10.19	12.19
Powers and roots—general	.38	0	0	.33	0	.18	0	.23	0	.60	0	0	0	
Involution	0	.07	.42	.15	0	.27	.15	0	1.36	.17	0	0	1.29	
Evolution	2.87	2.18	2.60	1.68	.74	2.32	2.00	1.81	1.23	1.51	1.88	0	2.14	
Total	3.25	2.34	3.02	2.17	.74	2.77	2.15	2.05	2.59	2.29	1.88	0	3.43	2.24
Progression—														
Arithmetical	.06	.47	.46	0	0	0	0	1.13	0	0	0	0	0	
Geometrical	.34	.32	.35	0	0	0	0	0	0	0	0	0	0	
Total	.41	.78	.81	0	0	0	0	1.13	0	0	0	0	0	.23
Properties of numbers	2.99	3.34	2.39	.92	.82	2.87	3.85	2.49	3.70	1.06	.67	.99	3.15	2.22
Ratio and proportion	2.04	1.69	1.95	1.05	.68	3.96	8.20	3.18	3.55	2.14	3.30	1.89	2.02	2.67
Stocks	.82	.17	1.20	.53	.26	1.50	1.84	2.11	.89	.82	.95	.93	1.06	.99
Taxes	.51	.37	.44	.27	.22	.37	.25	.74	.91	.57	.32	.88	.36	.48
Miscellaneous problems	4.56	9.03	6.64	14.78	8.81	7.02	6.12	5.94	7.12	1.69	12.74	12.88	14.14	8.68
Other miscellaneous items	1.54	0	0	1.11	0	.35	.89	3.62	.21	.59	1.41	0	0	.72
Total per cent	99.95	99.95	100.17	101.38	99.81	100.00	99.90	100.00	100.01	99.97	99.97	100.01	99.99	100.04

parts, arithmetic, reduction of fractions, single partnership, and geometrical progressions have been handled by three authors.

Other subjects, though included by all authors or by all but one or two, nevertheless receive only a small per cent of space. An example of this is longitude and time, which is included by all authors but receives only .65 per cent of total space. The metric system, included by all but one author, is given only 1.04 per cent of space. These cases, both where subjects are included by only one to three authors, and where subjects are included by all authors but are given little space, are two of the very few examples of a unanimity of opinion among the 13 authors.

From the standpoint of practical material, the analysis of the 13 series of this period does not show that the authors give large amounts of space to some subjects which are very necessary in business and in practical life. Such subjects as bills and accounts, bonds, federal money, stocks, and taxes are given very little space—a combined total of 4.20 per cent.

Interesting variations in amounts of space given to different subjects by different authors may be found all through the tables. Wide differences are found—and without rhyme or reason. One author gives a certain amount of space to a topic and the man immediately before or after him doubles it or cuts it into half. A good illustration of this is found in two of the later writers, Hornbrook (45) and Colaw and Ellwood, in the Johnson series (46): Hornbrook gives 15.21 per cent of space to fractions; Colaw and Ellwood cut this almost in half—7.98 per cent; but when it comes to fundamental processes, Hornbrook gives it only 17.95 per cent of total space, and the Johnson series doubles that amount to 36.81 per cent. In space given to total percentage, however, these authors are not so far apart—10.50 per cent and 13.00 per cent. The same kind of variations appear in Tables IV and V where Hornbrook gives less than half as much space as does the Johnson series to definitions and explanations, and twice as much as do Colaw and Ellwood to notes to students and teachers. It is difficult to determine any reasonable explanation for these wide differences of viewpoint as to subject matter.

The major topics in Tables I and II are listed in Table III in the order of total space given to each topic in the 13 books. This table brings into clearer perspective the consensus of opinion of the 13 authors as to the prominence that should be given to the different kinds of arithmetical material.

The conclusion might be drawn at once that this list is an accurate picture of the consensus of opinion as to the proportion of total space that should be given to particular subjects. In general, that is probably true, but we cannot be sure about particular items. For example, according to Table III percentage is voted second in importance and fractions third. But Table II shows that the vote is anything but unanimous; percentage received a bare majority of one per cent of space, while six authors thought the subject of fractions more important than that of percentage.

In the case of fundamental processes, which heads the list in Table

TABLE III. MAJOR TOPICS IN ORDER OF SPACE GIVEN TO EACH

Topics	Pages	Per cent
Fundamental processes	2,242.94	24.19
Percentage	1,129.91	12.19
Fractions	1,073.24	11.57
Miscellaneous problems	804.61	8.68
Geometry	610.66	6.59
Compound denominate numbers	526.54	5.68
Decimals	429.93	4.64
Measures, tables, and area	397.13	4.28
Numeration and notation	334.30	3.61
Ratio and proportion	247.53	2.67
Algebra	208.38	2.25
Powers and roots	207.37	2.24
Properties of numbers	205.95	2.22
Federal money	157.37	1.70
Metric system	96.63	1.04
Stocks	91.83	.99
Foreign and domestic exchange	82.34	.89
Bills and accounts	80.19	.86
Other miscellaneous items	66.34	.72
Longitude and time	60.00	.65
Taxes	44.60	.48
Partnership	33.99	.37
Cancellation	32.86	.35
Progression	21.32	.23
Aliquot parts	18.85	.20
Arithmetic	17.28	.19
Bonds	15.47	.17
Duties and customs	10.87	.12
Analysis	10.01	.11
Alligation	7.21	.08
Imports and exports	4.19	.05
Foreign money	2.43	.03

III, the vote is unanimous and decisive. In no case, as shown in Table II, does an author place either percentage or fractions, or in fact any other subject, ahead of fundamental processes. The "tool subjects" certainly receive their just dues when compared with any other particular subject. But in Table V it is seen that fundamental processes, when compared with a group of "types of content" closely related to each other, does not receive a disproportionately large amount of space.

Space given to each type of content—Tables IV and V show the total number of actual 400-word pages and the percentage of such pages given by each author to the different general types of processes usually found in arithmetics. The total pages shown for a particular book in Table IV do not tally with the total pages shown in Table I because in Table IV there is a considerable amount of overlapping. For example, the type of processes designated "combined addition or subtraction" includes material listed under drill problems, definitions, etc.

In making comparisons in this field, it is best to deal with Table V which gives in terms of per cent the picture of ways of handling content. There is little unanimity among the authors as to the per cent of space that should be used in handling the different subjects.

TABLE IV. NUMBER OF 400-WORD PAGES GIVEN TO EACH TYPE OF CONTENT IN ARITHMETIC TEXTBOOKS FROM 1881 TO 1910

Type of Content	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Smith series	Cook-Cropsey series	Total pages
	37	38	39	40	41	42	43	44	45	46	47	48	49	
Definitions and explanations	62.50	51.05	48.15	24.65	9.90	26.65	43.75	48.10	21.05	42.40	37.80	46.30	56.35	518.65
Tables and explanations	9.10	30.90	19.50	8.60	5.25	10.45	9.85	11.85	12.45	9.35	12.20	12.55	7.60	159.65
Rules and explanations	36.30	23.85	25.05	9.40	.75	5.60	6.54	32.65	15.05	7.75	6.40	8.05	7.10	174.49
Examples and explanations	57.50	66.90	67.05	51.15	14.50	66.40	42.10	77.40	12.75	35.85	31.30	54.80	79.55	657.25
Drill problems	132.40	99.90	159.95	178.00	265.55	163.00	204.35	245.70	289.75	214.30	243.90	189.50	164.55	2,550.85
Written problems	128.05	155.25	235.15	133.23	51.25	229.25	64.50	67.50	208.65	170.20	222.05	165.30	150.25	1,980.63
Combined addition	25.60	44.65	37.80	14.95	31.60	53.75	22.55	27.52	27.40	34.85	17.70	31.95	16.75	387.07
Combined subtraction	18.55	34.55	31.80	17.15	16.25	5.95	15.55	22.70	25.05	22.50	13.05	22.05	30.00	275.15
Combined multiplication	30.15	47.95	48.40	24.85	29.40	55.90	30.10	30.35	40.60	30.55	44.35	70.60	38.80	522.00
Combined division	33.35	40.55	59.25	28.35	29.85	38.35	24.25	34.45	24.85	30.30	35.55	38.25	30.10	447.45
Combined addition and subtraction	12.85	0	4.65	.65	13.85	14.75	10.15	15.45	7.75	54.59	13.65	6.90	13.40	168.64
Combined multiplication and division	12.95	0	.60	18.55	3.75	10.05	3.10	3.70	3.70	7.60	27.05	2.45	19.01	112.51
Combined reduction	17.75	9.75	15.90	0	.50	10.05	0	16.65	8.55	1.25	1.00	4.75	2.05	88.20
Questions	8.25	10.55	3.95	13.60	1.20	8.25	.70	0	4.30	2.95	21.35	2.90	8.15	86.15
Notes to teachers and students	5.45	9.60	0	.90	1.15	0	5.55	2.15	11.85	3.45	4.25	7.90	3.90	56.15
Miscellaneous	46.95	38.40	20.95	50.25	110.60	8.50	13.25	12.50	35.85	34.85	25.40	35.95	49.15	482.60
Total 400-word pages	637.70	663.85	778.15	574.28	585.35	706.90	496.29	648.67	739.60	702.74	757.00	700.20	676.71	8,667.44

TABLE V. PER CENT OF 400-WORD PAGES GIVEN TO EACH TYPE OF CONTENT IN ARITHMETIC TEXTBOOKS FROM 1881 TO 1910

Type of Content	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Smith series	Cook-Cropsey series	Total per cent
	37	38	39	40	41	42	43	44	45	46	47	48	49	
Definitions and explanations	9.80	7.69	6.19	4.64	1.69	3.77	8.82	7.42	2.85	6.03	4.99	6.61	8.32	5.98
Tables and explanations	1.43	4.65	2.51	1.50	.90	1.48	1.98	1.83	1.68	1.33	1.61	1.79	1.12	1.84
Rules and explanations	5.69	3.59	3.22	1.64	.01	.79	1.32	5.03	.68	1.10	.85	1.15	1.05	2.01
Examples and explanations	9.02	10.08	8.62	8.91	2.48	9.39	8.48	11.93	1.72	5.10	4.14	7.83	11.76	7.58
Drill problems	20.76	15.05	20.56	31.00	45.37	23.06	41.18	37.88	39.18	30.49	32.22	27.06	24.32	29.43
Written problems	20.08	23.39	30.22	23.20	8.76	32.43	13.00	10.41	28.21	24.22	29.33	23.61	22.20	22.74
Combined addition	4.01	6.73	4.86	2.60	5.40	7.60	4.54	4.24	3.71	4.96	2.34	4.56	2.48	4.47
Combined subtraction	2.91	5.21	4.09	2.99	2.78	.84	3.13	3.50	3.39	3.20	1.72	3.15	4.43	3.18
Combined multiplication	4.73	7.22	6.22	4.33	5.02	7.91	6.07	4.68	5.49	4.35	5.86	10.08	5.73	6.02
Combined division	5.23	6.11	7.62	4.94	5.10	5.43	4.89	5.31	3.36	4.31	4.70	5.46	4.45	5.16
Combined addition and subtraction	2.02	0	.60	.01	2.37	2.09	2.05	2.38	1.04	7.77	1.80	.98	1.98	1.95
Combined multiplication and division	2.05	0	.08	3.23	.64	1.42	.62	.57	.50	1.08	3.57	.35	2.81	1.30
Combined reduction	2.78	1.47	2.04	0	.09	1.42	0	2.57	1.16	.18	.13	.68	.30	1.02
Questions	1.29	1.59	.51	2.37	.21	1.17	.14	0	.58	.42	2.82	.41	1.20	.99
Notes to teachers and students	.85	1.45	0	.02	.20	0	1.12	.34	1.60	.49	.56	1.13	.58	.65
Miscellaneous	7.36	5.78	2.69	8.75	18.89	1.20	2.67	1.93	4.85	4.96	3.36	5.14	7.26	5.57
Total per cent	100.01	100.01	100.03	100.13	99.91	100.00	100.00	100.02	100.00	99.99	100.00	100.00	99.98	99.89

One would think that experience, tests, experiments, and the like would demonstrate the relative amount of treatment each type of content should receive. But in writing these arithmetics every author seems to have gone according to whim or caprice—or, if not that, at least according to his own ideas of value.

In every case, per cent of space given to each of the 16 different methods of procedure indicates a radical difference of opinion. One man (41) gives 1.69 per cent of his total space to definitions while another (37) gives 9.80 per cent, or six times as much. One author (41) uses .90 per cent of his total space for tables and explanations, while another uses 4.65 per cent, or five times as much. In rules and explanations, the range is from .68 to 5.69 per cent, the latter being nine times as much.

Even to the two types of processes, drill and written problems, which together are given over 50 per cent of the total space of all books, there is a radical variation in amounts of space given by different authors. In drill problems the range is from 15.05 to 45.37 per cent; in written problems it is from 10.41 to 32.43 per cent. The consensus of opinion of the 13 authors is that 29.43 per cent of space should be given to drill problems; but two men differ widely from this opinion.

Table V shows that by far the highest per cent of total pages is given by most authors to drill problems as compared with other types of content. Was this done because the authors were convinced that drill problems were the most important type of arithmetical procedure, or was it because the drill type of work was the easiest kind to prepare? One author (41), as shown above, uses 45.37 per cent of his total space for drill problems. He gives a total of only 2.11 per cent to definitions, rules, questions, and notes to students and teachers. Furthermore, he gives only 8.76 per cent of his total space to written problems. This same tendency to avoid too much mental exercise in the preparation of texts comes to light in another phase of this analysis and will be pointed out there.

Some interesting things are to be noted in connection with the analysis of the fundamental processes (addition, subtraction, multiplication, and division). But not a single trend can be pointed out since the later authors as a group did not noticeably increase or decrease the per cent of space given to any of these subjects. Multiplication shows the highest total per cent, but it is not because the later authors felt multiplication to be more important than the earlier authors believed it to be, since five of the last half dozen authors give it a lower per cent than do five of the first half dozen (they are arranged in chronological order). Again, multiplication is given a higher per cent of total space than division. But this does not show that there is agreement that multiplication is more important, for five authors give more space to division. Two or three authors, by giving a disproportionate amount to a particular subject, can make total per cents deceptive.

The greatest unanimity is found in giving subtraction the least amount of space among the four fundamental processes. Only two

authors give subtraction more space than they give to addition. But there is no trend toward decrease or increase of space for subtraction, the first half dozen authors giving an average of 3.21 and the last half dozen 3.13 per cent.

On the old controversy over the importance and neglect of the fundamentals of arithmetic this analysis throws an interesting light. Table V shows that about 90 per cent as much space is given to rules, tables, definitions, questions, notes to teachers, etc. combined as is given to fundamental processes—addition, subtraction, multiplication, division, and all combinations of these; that is, the mechanics of instruction take up almost as much space as the total amount given to actual work in the fundamentals.

Minor points of comparison and contrast may be noted without difficulty. The reader's individual interests will point the way.

Analysis of problem subjects—In order to obtain a fuller understanding of the actual content of the arithmetic texts of this period, a study has been made of the kinds of subjects around which the written problems are built. To get a complete picture, all concrete subjects in each book have been listed in alphabetical order and the number of times each subject is used has also been ascertained.

As a basis of comparison, these problem subjects were classified according to certain fields of interest or subject matter. Thirteen of these fields or classifications were chosen as samples and are given in Table VI, together with the number of words found in each field and the total number of times these words are used.

TABLE VI. NUMBER OF WORDS USED IN EACH OF 13 PROBLEM-SUBJECT FIELDS AND TOTAL NUMBER OF TIMES THESE WORDS ARE USED

Classification	Number of words	Total times used
Alcoholic beverages	6	66
Animals, fish, birds, and fowl	58	1,719
Building and construction terms and material	103	1,959
Clothing and cloth	64	2,034
Foods and farm products	135	6,075
Games and recreation	41	426
Household equipment	160	2,325
Metals and alloys	16	540
Metal articles	123	1,446
Military terms and references	20	69
Occupations	150	2,971
Schools and school references	28	1,133
Transportation and travel	55	1,839

Within these groups of problem subjects certain words are used much more often than are others. From each of the 13 groups, therefore, several words were selected which rank among the highest in frequency of mention. Table VII was then set up to show in detail which authors use these words, and how many times each word is used. The table also shows whether the four most recent authors of the 13 use the words more times or fewer times than the four earliest authors of the period. This gives the opportunity to see at a glance whether certain items came into current use during this

TABLE VII. FREQUENCY OF MENTION OF 83 OF THE PROBLEM SUBJECTS IN ARITHMETIC TEXTBOOKS FROM 1881 TO 1910

Problem Subjects	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Smith series	Cook-Cropsey series	Total	Times Used by First Four	Times Used by Last Four
	37	38	39	40	41	42	43	44	45	46	47	48	49			
Agent	8	17	21	19	0	25	26	33	6	14	24	8	21	222	65	67
Alcohol	0	0	0	5	3	1	0	0	1	2	7	2	0	21	5	11
Apples	19	50	40	24	12	30	48	35	31	60	56	21	52	478	133	189
Army	1	0	2	0	0	1	2	5	1	0	0	0	1	13	3	1
Automobile	0	0	0	0	0	0	0	0	2	0	2	7	3	14	0	12
Bags	2	1	6	8	13	4	1	8	3	9	8	8	9	80	17	34
Balls	10	4	11	6	16	4	3	4	7	12	6	9	6	98	31	33
Baskets	3	7	0	15	0	4	4	3	3	3	14	6	6	68	25	29
Battleship	0	0	0	0	0	0	0	0	0	0	0	5	0	5	0	5
Bicycles	0	11	7	17	1	20	16	3	24	13	19	2	3	136	35	37
Blackboard	0	3	2	9	1	10	4	1	0	12	10	48	2	93	14	72
Boards	0	0	0	24	0	11	18	27	11	20	0	0	5	116	24	25
Bottles	1	8	1	5	6	1	1	4	4	9	4	10	3	57	15	26
Butter	21	19	19	16	39	37	3	20	15	18	24	23	5	259	75	70
Calico	0	11	7	1	8	0	1	7	12	7	2	2	7	65	19	18
Cannon	0	0	0	0	1	0	1	1	0	1	0	0	0	4	0	1
Carpet	15	12	6	10	4	4	13	26	21	17	20	9	19	176	43	65
Carriage	8	17	19	5	0	10	7	16	7	5	14	5	9	122	49	33
Chairs	4	1	3	12	3	2	4	4	0	3	6	5	8	53	20	22
Chickens	1	1	5	3	1	1	4	2	2	7	7	5	1	40	10	20
Coats	4	15	12	1	7	3	3	3	9	9	6	4	7	83	32	26
Coffee	7	7	8	14	22	11	5	23	11	15	31	11	23	188	36	80

TABLE VII—CONTINUED

Problem Subjects	37	38	39	40	41	42	43	44	45	46	47	48	49	Total	First Four	Last Four
Copper	1	0	0	1	1	0	1	0	3	0	2	5	3	17	2	10
Corn	15	20	1	1	0	0	26	36	14	28	22	20	46	229	37	116
Cotton	8	7	12	14	3	1	4	25	0	2	19	40	0	135	41	61
Cows	15	30	27	1	35	0	12	11	2	45	7	6	11	202	73	69
Dealer	1	20	19	14	16	38	8	20	16	16	42	83	12	305	54	153
Desks	1	2	6	6	2	4	1	3	1	3	5	12	3	49	15	23
Drover	21	14	16	0	3	12	1	29	0	11	0	0	0	107	51	11
Eggs	9	23	34	36	37	26	28	17	13	43	43	30	21	360	102	136
Farmer	40	62	83	17	55	48	25	86	26	44	65	29	34	614	202	172
Fence	1	1	1	4	24	5	14	8	17	24	12	4	16	131	7	56
Fish	2	6	9	0	0	1	1	1	11	1	4	4	0	40	17	9
Flagstaff	0	2	3	0	1	0	1	2	1	0	0	0	0	10	5	0
Flour	42	31	18	19	44	37	20	85	17	26	43	8	24	414	110	101
Gold	3	7	6	11	1	6	4	16	2	1	1	13	16	77	27	31
Grocer	28	37	22	12	31	23	8	24	11	15	18	19	19	267	99	71
Hogs	4	1	0	1	1	1	0	23	2	1	2	3	2	41	6	8
Horses	34	66	87	30	50	64	51	79	31	85	64	15	36	692	217	200
Hounds	2	1	5	0	0	0	15	0	0	1	0	0	0	24	8	1
Houses	26	39	50	27	34	48	32	92	56	37	92	29	28	590	142	186
Iron	9	4	6	3	6	2	2	10	2	8	6	8	1	67	22	23
Kites	0	1	2	0	4	0	6	0	5	1	3	3	2	27	3	9
Knives	2	8	1	3	2	3	0	3	5	11	5	2	4	49	14	22
Lace	1	4	6	2	9	6	8	0	13	1	5	3	6	64	13	15
Ladder	2	2	0	0	0	3	2	0	2	0	3	2	5	21	4	10
Merchant	23	49	77	22	31	90	19	79	22	37	45	15	34	543	171	131
Milk	6	8	17	21	28	35	16	3	19	35	28	29	18	263	52	110
Muslin	0	14	16	0	22	1	3	10	1	5	2	3	12	89	30	22
Oats	12	7	26	15	15	23	14	23	3	30	29	12	26	235	60	97
Oranges	11	13	31	13	30	24	10	11	23	27	28	17	32	270	68	104
Pen	2	2	3	11	4	0	1	3	0	2	4	6	3	41	18	15
Pencils	7	9	6	18	6	16	8	4	5	16	26	22	20	204	40	84
Pianos	0	4	4	7	3	2	4	0	10	6	7	0	8	54	15	21

TABLE VII—CONTINUED

Planks	0	0	2	4	2	0	1	11	0	7	5	1	4	37	6	17
Poles	2	5	7	4	1	6	0	2	5	9	5	3	9	58	18	26
Potatoes	5	23	28	11	11	24	16	21	11	21	32	18	28	249	67	99
Pupils	5	13	15	4	9	20	24	22	57	19	13	25	15	241	37	72
Rabbits	0	2	2	0	1	0	0	1	2	9	2	6	0	25	4	17
Railroad	0	11	16	4	7	0	2	11	3	21	9	8	5	97	31	43
Ribbon	2	9	13	19	34	29	22	1	23	6	24	21	25	246	43	76
Sailors	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0	0
Schoolroom	2	1	3	14	1	6	5	4	11	7	13	6	18	91	20	44
Schools	11	14	15	15	8	10	3	7	22	15	18	53	17	208	55	103
Sheep	12	14	34	6	40	24	8	38	1	57	31	17	15	297	66	120
Shingles	0	2	2	0	0	4	7	5	2	0	8	5	3	38	4	16
Ships	4	0	18	1	5	14	5	10	0	5	1	9	0	72	23	15
Silk	16	13	19	2	34	12	10	14	13	7	18	23	15	194	50	63
Silver	6	2	2	5	12	2	5	14	0	21	7	6	5	87	15	39
Soap	2	1	2	4	10	10	1	0	1	1	8	8	5	53	9	22
Stone	7	9	3	0	1	6	6	11	2	6	5	5	7	68	19	23
Sugar	22	33	39	20	52	21	17	60	16	22	37	28	30	397	114	117
Tables	1	2	7	7	4	6	2	2	3	8	2	2	4	50	17	16
Tea	7	10	19	18	78	29	8	23	3	7	34	9	15	260	54	65
Teacher	0	4	6	3	1	4	0	1	63	5	13	17	7	124	13	42
Tin	3	1	0	1	3	1	1	0	6	5	1	4	4	30	5	14
Tops	0	4	2	0	4	2	2	0	3	5	1	0	5	28	6	11
Trains	5	6	21	7	19	18	9	10	4	22	9	8	19	167	39	58
Velvet	7	5	2	3	2	0	2	2	3	4	5	5	7	47	17	21
Wagon	5	4	12	1	10	2	11	8	14	18	4	6	6	101	22	34
Wheat	47	19	57	14	25	55	27	85	25	53	43	25	39	514	137	159
Windows	0	0	8	0	0	1	5	7	3	1	0	3	11	39	8	15
Wine	1	2	1	1	1	4	2	12	4	5	2	0	3	38	5	10

period, or dropped out of use, or perhaps changed in usage very little or not at all. Certain trends might thus be discovered.

Table VIII also gives the total number of different problem subjects used by each of the 13 authors and the number of 400-word pages in each series of texts. The average number of problem subjects per page shows whether an author used a wider or narrower variety of subjects in making problems than did other writers.

There are several tendencies that may be mentioned in the use of problem subjects. While it is readily seen that common everyday subjects are used in problem construction, it is noted that the authors overuse many of them. The tendency is to select a favorite word and to "ride it to death." For example, horses are used as a problem subject 692 times. One author (37) uses the word 87 times, and another author (46) uses it 85 times. Two authors, (44) and (47), use houses 92 times each; and all the authors together, 590 times. Certain foods receive undue notice: apples are used 478 times; butter, 259; oats, 235; oranges, 270; eggs, 360; potatoes, 249. These items were common and familiar, of course, but their continued use certainly tends toward making the problems monotonous. Further examples are plentiful. Farmer is used 614 times; dealer, 305 times; agent, 222 times; merchant, 543 times. These four gentlemen do 56 per cent of all the work allotted to all occupations.

Certain words not included in Table VII showing the selections from the 13 classifications occur an undue number of times. In analyzing the books of this series, the words denoting measurement have not been recorded. The word "acres," however, is included because in many cases it stands for land or farms. This word is used as a problem subject 792 times! Other words of this group are: land, used 528 times; farm, 504 times; man, 776 times; stocks, 549 times; and books, 394 times.

Another tendency in the selection of problem subjects is to use general or generic terms much more often than specific terms. For example, apples are used 478 times—but a good juicy Jonathan, or a beautiful Belleflower, or a wormless Winesap is not mentioned; and, again, houses are used 590 times, but a beautiful bungalow not once. Man, man, man, 776 times, but hardly an Englishman, Chinaman, Russian, Negro, or Red man in the lot! Corn is mentioned 229 times but Country Gentleman or Stowell's Evergreen not at all! Horses are led in 692 times, but what kind—Percheron, Belgian, Clydesdale? In nearly all cases there is no mention of breed and the student is left to take it for granted that the horses are just plain plugs.

Some noticeable contrasts in frequency of mention are found: milk is mentioned 263 times, but ice cream only once! Oranges are used 270 times but grapefruit only once; cheese, 60, but pie only 9 times! Bread is mentioned 28 times but mince-pie just once. The authors certainly do not use the subjects most popular with children.

In an analysis of this table one may see a few differences in the number of times a problem subject is used by the first four and last four authors. For example, the automobile is first mentioned by Hornbrook (45) in her *Advanced Arithmetic*, written in 1900. Then

the last three authors mention this item 12 times. Another item of interest is that battleships are mentioned by only one man, Smith (48), writing in 1904, although six of the 13 sets of arithmetics were written after 1898, the year the battleship *Maine* was sunk by the Spaniards. The popular slogan had been "Remember the *Maine*," but only one of the six authors remembered.

In several cases the per cent of increase or decrease in use of a particular subject would seem to indicate a radical change in interest. But in these cases the frequencies of mention are too small to afford a basis for conclusions. For example, the word "army" shows a 67 per cent decrease in use—but it is used only three times in the first five books and one time in the last four. The same is true of hounds, 8 to 1, and ladder, 4 to 10. Per cents in these cases have no significance.

A few words were evidently dropping out of use as problem subjects because they were no longer of interest or because they were no longer familiar. For example, the word "drawer" drops from 51 to 11. On the other hand, certain articles of commerce and certain commodities and foods were coming into greater use. Examples of these are bags, increasing from 17 to 34; copper, 2 to 10; coffee, 36 to 80; corn, 37 to 116; milk, 52 to 110; silver, 15 to 39; tin, 5 to 14; and wine, 5 to 10.

Perhaps the most noteworthy tendency in the use of problem subjects is found in connection with terms that have to do with education. In almost every one of these terms there is an increased use. Blackboard increases from 14 to 72; desks, from 15 to 23; pencils, from 40 to 84; pupils, from 37 to 72; schools, from 55 to 103; schoolroom, from 20 to 44; and teacher, from 13 to 42. Certainly these increases manifest a definite trend toward a much fuller use of a group of problem subjects which were constantly at hand.

Table VI is included chiefly to give a condensed picture of the variety of problem subjects used by the different authors, and to show the breadth of vocabulary exhibited by some as compared with others. Paucity of subjects is indicative of one of two things: either the author is limited in his knowledge of subject matter, or he is unwilling to take the time and trouble to select and use a wide variety of subjects.

As evidenced by the texts at least, there is a wide difference in the working vocabularies of some of the men. For example, Walsh (41) uses only 400 different problem subjects as compared with Southworth (40), who uses 898, and as compared with the average of 581 used by all authors.

Perhaps a better, or truer, comparison is found in the averages of the number of problem subjects per page, as shown also in Table VIII. The lowest is Southworth-Stone (47) with an average of only 2.17 per page of written problems as compared with Woodward (44) with an average of 9.59 per page.

Table VIII is also a commentary on the claims made by the different authors as to the practicality of their books. The natural conclusion would be that the wider the variety of problem subjects used the more interesting the book would prove to be to the pupils;

TABLE VIII. TOTAL NUMBER AND AVERAGE NUMBER OF DIFFERENT PROBLEM SUBJECTS IN EACH BOOK

	White series	Indiana Educational series	Milne series	Southworth series	Walsh series	McClellan-Ames series	Indiana Schoolbook series	Woodward series	Hornbrook series	Johnson series	Southworth-Stone series	Cook-Cropsey series	Smith series	Total	Average
	37	38	39	40	41	42	43	44	45	46	47	48	49		
Total number of different problem subjects in each series	413	463	843	898	400	583	507	647	515	452	481	731	668	7,551	581
Number of 400-word pages of written problems	128.05	155.25	235.15	133.23	51.25	229.25	64.50	67.50	208.65	170.20	222.05	165.30	150.25	1,980.63	152.35
Average number of different problem subjects per page	3.23	2.98	3.58	6.74	.78	2.32	.79	.96	2.47	2.66	2.17	4.42	4.45	3.81	

and the more interesting the book, the more practical, in that it leads to more enthusiastic and thorough study of the subject matter.

Sample problems showing subject matter—In the preceding bulletins of this series of analysis of arithmetic texts, several word lists were included showing problem subjects which had become obsolete, or were rarely used, or were unfamiliar to people of this generation. Many articles of clothing, kinds of cloth, trade terms, occupations, and the like, mentioned in the earlier series, are strange to the ears of most readers of today. But in the analysis of the books of the 1881 to 1910 period few such strange terms come to light. In fact, of the thousands of problem subjects used, a paltry total (perhaps a half dozen) was found with meanings that are not familiar today; and most of these are in the realm of dress goods. Word lists such as have been included in the earlier studies cannot, therefore, be included in this bulletin.

It must not be inferred, however, that there has been a trend away from the use of obsolete or unfamiliar terms in problem making. There is little or no proof that, at the time they were used, the terms in the earlier books were obsolete. It can be said here merely that the 1881-1910 period is so close to the present time that we are familiar with practically all problem subjects used by writers in that period. It can be said definitely, also, that in problem construction these authors led the pupils of this period along familiar paths.

In order to see more definitely the relationship between the kinds of problems presented in the arithmetics of the period from 1881 to 1910 and the actual ordinary life situations which prevailed at that time, it is necessary to have sample problems from many different fields of activity. From these samples it may be possible to determine whether the authors succeeded in relating their books to the needs and conditions of the period.

In another section of this study, some sampling has been done which reveals that all the authors slipped up in a few cases in their efforts to include only accurate and practical problems. But these selections constitute only a small percentage of the total problems of each book, and by no means prove that the books are not practical. A fuller sampling of the problems from 21 different fields or phases of life should throw additional light on the questions.

Agriculture—

In the field of agriculture, for example, a great variety of farm products, farm practices, and farm animals are made use of in drawing up problems. The following are typical:

A farmer gave 55 sheep for 11 young horses.
One acre of land produces 48.37 bu. of wheat.
If the United States produces 547,303,000 bu. of wheat in one year, worth 70c a bu. . . .
When this country produced 2,105,102,400 bu. of corn a year, averaging 25 bu. to the acre. . . .
In a year when the census showed 18,108,666 cows kept for milk, their value was estimated at $543,259,980.

The greatest recent average yield of potatoes per acre was in Nevada, where 1,753 acres produced 190 bu. to the acre.
Cotton was first planted in the United States about 1759.
When hay is worth $20.3/4 per ton, how much will 7/12 of a ton cost?
Mr. Ward sells 7 qt. of milk at 8c.
A farmer bought a home for $100. He traded his home for a yoke of oxen, and sold the oxen for $120.
If a farm hand should earn $20. for laboring 4 weeks. . . .
A farmer bought 7 oxen at $65 each, nine cows at $42 each, and 120 sheep at $5.50 each.
Three men bought a threshing machine at $560.00.
A farmer wintered 17 horses from Dec. 1 to Apr. 1 at $12. per mo.
Land in one part of a certain county in Illinois is worth $20 an acre.
A sugar plantation produces 2,000 bbl. of sugar.
A rectangular watering trough is 6 ft. long, 18 in. wide, and 14 in. deep.
If a poultry raiser sets some eggs and 15% fail to hatch. . . .
A farmer raised 6,824 bu. of grain. By fertilization he increased the yield the next year by 8¾%.

These samples show that the authors as a group had a wide knowledge of farm life and used it in a way that would appeal to farm youths.

Business transactions—

A great many of the problems brought into use by the different authors have been drawn from the field of business. These are of an exceedingly wide range and deal with subjects of interest to youths from many districts and from many walks of life.

A drummer earns $2,500 annually; $1,000 is guaranteed salary. The remainder is his commission of 5%.
A drover bought 39 oxen from one man, 48 from a second, and 59 from a third.
By selling a house for $5,700, a man made a profit of $250.
A merchant's sales for January amounted to $28,000, but 12% was lost in bad debts.
An invoice of jams is charged at $2,500 on six months' time.
A dealer bought a boat load of coal for $300.00, and by retailing it at $6.25 a ton, gained $75.
A merchant failed owing $18,500, with $7,200 assets.
Mr. Godfrey, owning 2/11 of a silver mine, sold 2/3 of his share for $13,000.
A man borrowed $8,000 in Boston at 4½%, and loaned it in Oregon for 8%.
A wholesale dealer marks bicycles at $60, subject to a discount of 33 1/3%.
A wine merchant imported 200 doz. quart bottles of champagne at $14 per doz.

The samples given above are just a few selections from hundreds of similar problems. It will be noted that even the few selected range from jam on the shelf to silver mines in the mountains.

Children's occupations—

Children's occupations is a field in which the pupils would have a natural interest; a field also which would test the author's knowledge of children and his ability to make use of common material. The

comparatively small number of problems in this field would indicate one or more of the following: there were not many kinds of work for children during this period; not many children were engaged in any occupation; the authors were unfamiliar with the field; or, the work in which children were engaged was not considered of sufficient interest or of sufficient value to be used in problems.

A sampling of the occupations mentioned is of interest:

A boy purchased 10 copies of a newspaper for 20 cents and sold them for 30 cents.
Helen used 16 eggs in making 4 cakes.
Jennie sewed 6 buttons on her shoes.
If Frank and James can mow the lawn in 2 hours. . . .
Willie gathered a bushel of chestnuts.
Henry gathered a bu. of beans from his garden and sold them for 25 cents a peck.
If you are building a play-house and need a stick 15 7/8 in. long for a window sill. . . .
A boy is offered a salary of $7 a week in a store.
A boy has been given an acre of land for a garden.
John drives the cows home to be milked each morning and evening.
Two boys formed a partnership to mend bicycle tires.
Walter and Thomas sold lemonade at a fair.
Anna and Mary each picked 9 qts. of berries.
Two boys received 24 cents for cutting wood.
Three girls made paper dolls for a fair.
Six boys are hoeing corn.
A boy sold 8 fishes for 4/5 of a dollar.
If three boys gather daily 2 gal., 3 qts., 1 pt. of sap from each of three trees. . . .
If an office boy earns 75c per day. . . .

Among the problems found in this field, by far the largest number have to do with selling newspapers, picking berries, gathering nuts, and taking care of vegetable or flower gardens. While there is a fairly wide range of subjects, not many of these subjects have been used exhaustively.

Education and schools—

Education and schools, as a field from which to draw problem material, was used rather extensively by most of the 13 authors. Matters of costs, attendance, equipment, teachers' expenses, class work, books, size of classes, grades, distances which pupils live from schools, and various other things have been freely drawn upon. The following items are a fair example:

If 42 pupils were divided into six equal classes, how many in each?
If in a school of 575 pupils, the number of boys is 7/16 the number of girls. . . .
If there are 78 school buildings in a city and an average of 690 pupils in each. . . .
Milton's geography cost 75 cents, his reader 39 cents, and his slate 18 cents.
A lad rides each day 8 miles in going to and from school.
A lesson in arithmetic contains 30 examples.
A certain school had 6 blackboards, each 9 ft. 4 in. long and 3 ft. wide.
In a certain school the salary of the teacher was $800.
A girl's entire expense at a boarding school was $6 per week.

In a school containing 567 white children every tenth child is colored.
On Friday there were 68 pupils present in a school and 12 absent.
A girl received 100 per cent in three studies and 80 per cent in the fourth. What is the average?
The schoolroom thermometer registered 63° and then rose 3°.
There are 255 pupils in the grammar grade and 41 in the high school.
School is in session from nine o'clock to twelve, and from a quarter after one to half-past three.
Of 30 pupils in a certain grade, three were not promoted.
Of 72 students who tried to pass the entrance examination to a university, 16⅔% failed.
There were 392 books in the school library, and 219 new ones were added.
When Arthur was a year old his father placed $50 in the bank for college expenses. He put $50 in the bank every birthday till Arthur was 18.
The ratio of children in school to the total population is 1:5.
In a city having 3,210 school children, 16 2/3% never missed a day of school last year.

Dress—

Another broad field which has proved to be a fruitful source of problem content is that of dress or wearing apparel. In a large proportion of the problems dealing with this subject the question of cost is of chief interest. The prices of some articles of apparel are much lower during the 1881-1910 period, if the prices quoted are *bona fide*, than they are today.

Some problems dealing with dress are the following:

A lady gave $42 for a dress, $7 for a bonnet, $2 for a pair of gloves, and $5 for a pair of shoes.
If it takes 2½ yds. for a jacket, and 3½ yds. for a coat, how many yds. for both?
A woman spends a dollar for 6½ yds. of calico at 8 cents a yard, and some ribbon at 32 cents a yard.
What will 9 pairs of boots cost at $5.25 a pair?
Samuel bought a coat for $20.25, a vest for $7.50, and a pair of trousers for $9.75.
Silas bought a pair of shoes for $2.50 for which the dealer paid $2.00.
John's overcoat cost eighteen dollars. His hat cost 1/6 as much.
If I buy a collar for 25 cents, some gloves for 37 cents, and some ribbon for 8 cents. . . .
The cloth of Ruth's dress cost $8 3/4. The making cost 4/5 as much, the trimming cost 7/10 as much as the making, and the linings cost 3/7 as much as the trimmings.
A man bought a hat for $2½, a vest for $2 3/4, and a linen coat for $1½.

Foods—

As in the matter of dress, most of the problems in the field of foods also have to do with costs. The foods mentioned are among those common with us today. The prices given are on the whole much lower than the price of such foods today, but were no doubt in line with the facts of the time. The following are fair samples:

If a turkey weighing 10½ lbs. cost $1.68. . . .
I paid $.70 for 3.5 lbs. of porterhouse steak.

What is the cost of 26.25 lbs. of sugar @ $.0625?
If 0.8 of a gallon of cream cost 30 cents . . . .
How many pounds of butter can be bought with 3/4 of a dollar, if one lb. costs 1/8 of a dollar?
I bought a bu. of tomatoes for 70 cents; a half bu. of turnips at 20 cents, and a peck of beans at 10 cents. . . .
A lady stopped at the grocer's and ordered 3 heads of lettuce at 9 cents each, and 2 bunches of asparagus at 6 cents each.
What will be the cost of a pint of maple syrup if a quart is worth 22 cents?
The cost of a live turkey weighing 14 lb. was $2.00. The waste in dressing was 3/7 of the weight of the turkey.
The price of California peaches was $3/4 per dozen in July.
Mary paid 10 cents for a dozen peaches and 2 cents apiece for bananas.
A grocer bought 60 gal. of maple syrup for $30., and sold it at 16 cents a quart.
Hiram bought 6 pecks of berries at 50 cents a peck and sold them at 15 cents a quart. What was his profit?
A farmer exchanged 45 lb. of butter at 24 cents a lb. and 6 doz. eggs at 12½ cents a doz. for cloth at 20 cents a yard.
When 7 lbs. of sugar cost 87½ cents how much do 3½ lbs. cost?

Health and sanitation—

On matters of health and sanitation the authors had very little to say. Few problems are based on this subject and most of those that are center around the question of necessary air space for school children. Samples of these problems are:

An epidemic decimated a Southern village leaving it with 639 inhabitants.
A schoolroom . . . seats 49 pupils. Each one needs 1,800 cu. ft. of air an hour.
Every person breathes on an average 28 cu. ft. an hour.

Some of the pictures found in the later books of the period might have been intended as suggestive of health problems or of sanitation. It is possible, of course, to read into the pictures more than the author intended. But some problems are based on pictures which are suggestive of sanitary methods. For example, a dairyman is pictured in White's elementary book (37), published 1883, using a long-handled dipper in pouring milk into a pitcher which the housewife has brought out to him in the street. The large milk can in the dairyman's vehicle is open to the dust of the street. In a later book, Smith's primary text (48), published in 1904, a dairyman is pictured delivering milk in sanitary capped bottles. In neither case is any statement made as to sanitary methods; nevertheless the pupils are led to observe the actual conditions.

Other pictures in White's primary text (37) show unsanitary conditions; for example, a dog in a grocery store, and apples being shoveled into barrels from a barn floor in front of horses which would be breathing and coughing over the apples day by day. Such conditions no doubt were common and not considered unsanitary. Later authors, perhaps, would not permit such pictures to be included.

Historical information—

A great many references to history are found in the series covering

1881 to 1910. Most of them are to particular dates of important events. In some books such references are found grouped on one or two pages and, no doubt, became monotonous to pupils. Many of the books, however, include an interesting variety, and furnish a great deal of informative material. The following are a few selections:

China is to pay Japan an indemnity of $160,000,000. One half is to be paid at once, and the remainder in 6 years, with simple interest at 6%.

Alaska was ceded to the United States by Russia June 20, 1867.

How many years between the breaking out of the American Revolution, April 19, 1775, and the declaration of war against Great Britain, June 19, 1812?

Columbus discovered America in 1492. George Washington was born in 1732. Henry Hudson discovered the Hudson River in 1609. The Pilgrims landed at Plymouth in 1620. Boston was founded in 1630. The first American newspaper was printed in Boston in 1704. The Declaration of Independence was signed in 1776. George Washington became president in 1789. The first passenger railroad in America was begun in 1828. The Great Chicago fire was in 1871. Our war with Spain began in 1898.

Gold was discovered in California in 1848. How many years ago was that?

How many years are there between the establishment of the Republic of Rome in 509 B.C., and the Declaration of Independence in 1776 A.D.?

How long from the destruction of the battleship Maine, February 15, 1898, to the destruction of the Spanish fleet in Manila Harbor, May 1, 1898?

How many years from Centennial exhibit at Philadelphia in 1876 to Columbian exhibit at Chicago in 1893; from the battle of Lexington in 1775 to the firing on Fort Sumter, 1861?

Human relations—

Examples in this interesting field are few in number. Is it because the authors were not socially minded, or because such problems were not popular during this period? It is quite certain that, in any period, there would be no lack of material in this field.

A southern county contains 14,700 blacks; 33 1/3% of the population are white.

A charity concert realizes $200.85 for the benefit of the poor. The expenses were 35% of receipts.

Some boys bought a pie, and each ate 25% of it. If the whole pie was consumed, how many boys were there?

A millionaire left a fortune to a college, three churches, and an orphan's home.

A man willed $98 more to each of his two sons than to each daughter, and to the widow $536 less than to his 5 children.

8 children give 9 cents each to a children's Aid Society.

A man bought 358 bu. of corn at 78 cents a bushel; he distributes 38 bushels among his poor neighbors.

Dr. Henry Pratt has made 12 visits to Mrs. Mary Pauls, whose daughter has been ill. His charge is $1.50 a visit. He has furnished $2.75 worth of medicine.

A drove of 8,450 cattle on their way north from Texas was stampeded by Indians and 30% were stolen.

On Christmas day Mr. Brown divided $3 1/5 equally among 4 poor children.

Industry—

In order to make their arithmetic texts practical for a large group of students living in or near industrial centers, a fair selection of problem subjects from the field of industry has been included in most of the books. As samples from this field the following selections have been made:

A mining company produced 17,687 oz. of gold worth $20.67 an ounce and realized 30% profit.

A furniture factory made 280 tables which sold at $3.00 each.

An iron foundry made 875 stoves in one week, 873 in another week, and 884 in another.

The Bloum's Plow Works made 12,345 plow joints in June, 12,675 in July, etc.

A manufacturing corporation makes $20,000 a year over all expenses. The stock consists of 4,000 shares, $7.50 par value; what rate dividend may be declared?

There are 2,741 operatives in a corporation. 12 overseers get $3.50 a day; 25 second hands get $2.50, 1,305 earn $1.50; 215 men and 731 women earn $1.25 each and the remainder 96 cents each.

A glass factory in Newark made in one day 1,760 tumblers, 860 goblets, 2,125 ounce bottles, 1,240 two-ounce bottles, 375 fruit jars, 3,600 glass tubes, and 1,200 other articles for laboratory purposes.

It requires 7,020,000 bricks to build a foundry. How many teams will it require to draw the bricks in 60 days, 6 loads a day, if 1,500 bricks is a load?

The receipts of a factory for a certain year were $1,374,837.64 and the expenses were $1,100,095.75. What were the profits?

A cabinet maker finds that each of 18 desks which he is making requires 5¼ dozen screws.

An organ manufacturer sold during 1891 nine church organs, the average price of which was $7,963.00.

Insurance—

The amount of business carried on in insurance during the years 1881 to 1910 would be, as we know, comparatively small as compared to the amount transacted since that time. The number of problems based on different types of insurance is comparatively small.

A factory worth $45,000 was insured for 2/3 of its value, at 1 3/4%.

A man insured his life for $8,000, paying $26.30 for $1,000. If he should live 20 years after he was insured, what would be the amount of the premiums paid?

What would it cost to insure a building worth $9,840 for 2/3 of its value at 7/8%?

A man at the age of 40 years was insured for $3,000, at the rate of $17.60 for $1,000 payable semi-annually.

A steamer and cargo worth $450,000 are insured for 3/5 of their value. The premium is $6,750. What is the rate?

Home economics—

For some reason the field of home economics has not been utilized very fully in the making of problems. It is a fruitful field, and one quite familiar to both boys and girls. Home work, home problems, home supplies of all sorts could have been used freely as subject matter for problems and would certainly have been more practical and

more interesting than some of those included from other sources. A few of the home economics subjects used were:

The weight of materials for a recipe for blueberry pudding for a family of 6 is as follows: . . .

In buying 2 dozen cans of peaches, how much is gained by buying at $3.75 a dozen, over buying at 3 cans for a dollar?

Mrs. Smith's wash bench is 4 feet long and 1 3/4 feet wide. A tub is set upon it in such a way that the lowest hoop touches the front edge and also the back edge without extending over. What is the circumference of the top?

An extension table is 12 feet long when its four boards are in and 7 feet long when they are out. How wide is each board?

A lady bought a rug for 4 ten dollar bills, a desk for 2 ten dollar bills, and a chair for $8.

How many strips of ingrain carpet will be needed for a room 18 feet square? How many running yards?

A lady has two silver cups and only one cover for both. The first cup weighs 16 oz. and when it is covered weighs 3 times as much as the second cup; but when the second cup is covered it weighs 4 times as much as the first. What is the weight of second cup and cover?

Mr. Bacon gives his daughter Louise $150 to furnish her room. She pays $65 for a chamber set, $22 for a sofa, $16.25 for a bookcase, $31.62 for a carpet, and the rest for pictures.

A woman bought a sewing machine for $64 and agreed to pay for it in installments of $4 a month.

A floor is 18 feet long and 3 yards wide: What will it cost to cover it with linoleum at $1.25 per sq. yd.?

Interesting items—

Some examples are given here of a type of subject used to some extent by all authors. Items of information and unusual and unrelated facts are given which might be classified as miscellaneous. Not all are really useful facts, but to many students all would be interesting. From the standpoint of assisting the pupil to be well informed, these problems could be rightly classified as practical.

The President of United States gets $50,000 a year. [This item is given in almost all books. Why not salaries of congressmen and cabinet members, etc.—for comparison and information?]

Take some number, double it, add 20, divide by 2, take the first number; you have 10 left.

The tallest church spire in the world is that of the Cologne Cathedral, 501 ft.

The tallest column is the Geo. Washington Monument which is 555 ft.

The largest cathedral in the world is St. Peter's at Rome. It has a standing capacity of 54,000.

Every 10 people in the United States consume on an average 650 lbs. of sugar annually.

We have 195 life-saving stations on the Atlantic and Gulf coasts, 58 on the Great Lakes, 16 on the Pacific, and 1 on the Ohio.

A grocer bought 75 lbs. of soap at 6¼ cents a lb. While on hands it dried away ¼ in weight. He sold it at 8 1/3 cents a pound; gain or lose?

The skull has 8 bones, the face 14, the ear 3, the trunk 53, the shoulders 4, an arm 3, the wrists 16, the hands 38, the legs 8, ankles 14, and the feet 36.

The largest bell in the world is in Moscow. It weights 216 T. A bell in Burma weighs 117 T. One in Pekin weighs 53 T.

The great pyramid, whose base is square, measures 763.4 ft. on each side. The slant height is 612 ft.

Gold weighs 19.36 times as much as water, and a cubic foot of water weighs 62.5 lbs.

Labor—

If the scarcity of problems in this subject-matter field is any criterion, the 13 authors of this period did not have much interest in a knowledge of labor. A large percentage of pupils in the grades undoubtedly came from the families of laborers. Were the interests of these children purposely disregarded?

If a bricklayer's hod contains 20 bricks, how many loads must be carried for a drain requiring 2,920 bricks?

A California hop-picker picks 3 bags of hops a day, averaging 60 lb. to the bag.

What will it cost to plaster a room 16′ x 14′, 9′ 16″ high, at 18 cents a sq. yd.?

If it takes a man 10 minutes to saw a log into 3 pieces, how long to saw into 4 pieces?

Living expenses—

Much greater use might be made of subjects from this field than is made by most authors. Perhaps it was felt that children are not much interested in living expenses as such. Nevertheless, large numbers of items from this field might have been used as a basis for problems.

The coffee for our breakfast cost 6 cents, the potatoes 4 cents, the meat 32 cents, and bread 4 cents.

A man's income is $16.50 a week, and his weekly expenses are $20.45. If he has $158 in reserve, how many weeks can he live without incurring debt?

My salary is $84 a month. I spend 1/3 of this for board, 1/6 for clothing, and 1/4 for other expense.

Last year my coal cost me $61.50. This year I bought 8 T. at $6½ a ton.

If it costs $40 to support a family of 8 persons for 2½ weeks, what will it cost to support 11 persons 4 weeks?

A clerk earned $75 per month. His expenses during that time were as follows: board $22½; washing $5 3/8 and other expenses $16 2/3.

A bookkeeper receives an annual salary of $3,500. He expends 10% for board, 6% for clothing, 4% for charity, and 35% for other expenses.

If you should work 310 days in a year and spend 82½% of your income for living expenses, how much would you have to earn a day in order to save $108.50 a year?

A physician whose charges are $2 a visit averaged 5 visits per day in 365 days. He collected 55% of his charges and saved $2 out of every $5 collected.

Owing to a deficiency in the appropriations bill, the salaries of clerks in a bureau were reduced 18%.

Military information—

Although the war with Spain was fought during this period, the authors writing after 1898 make little use of the facts and occurrences of that conflict. This field was not exploited as one might expect it to be. Army movements, courageous military exploits, war facts, are

scarcely touched upon. A few interesting examples, however, have been found in this subject field.

An army used 48,512 pounds of meat each week. How much in 13 weeks?

The expense of an army in Europe is, on the average, $195 per man. How much will it cost to keep an army of 32,596 men?

If 84 men form a military company, how many companies can be formed by 1,092 men? [This same problem was found in another book.]

An army numbered 236,960 soldiers. When detailed for regular service, 36,875 were found to be unfit for duty.

A garrison of 600 men has provisions for 80 days; how many men must leave to make the provisions hold out 20 days longer?

Ten per cent of an army were slain on the field of battle, and 5% of the remainder were wounded.

A garrison of 1,200 men has rations for 40 days; ten days later it receives a reinforcement of 300 men. How many more days will the rations last?

Gunpowder is made of 15 parts of saltpeter, 2 of sulphur, and 3 of charcoal.

The Military Academy at West Point was founded by Congress March 16, 1802, and the Naval Academy at Annapolis was opened Oct. 10, 1845.

Morals—

Questions of ethics or morals are touched upon in some of the problems found in the series of texts. But the number of problems involving morals is quite small. In most cases mere facts are given, with no comment as to the immorality involved. It is interesting to note that cases of unethical practice are restricted to a very few classes of people, i.e., merchants, farmers, icemen, etc. The big-time grafters, politicians, publishers, industrial leaders, and capitalists are not mentioned.

An iceman delivered a block of ice 1 ft. long, 5/8 of a foot wide, and 3/4 of a foot thick and charged for 50 lbs.

A paymaster receives $150,000 from the treasury, but fails to account for $2,250. What is the percentage of loss to the government?

Some people feel that if the seller reduces his price they are buying at a bargain. I wish to take advantage of their weakness by marking a certain line of goods which cost me $1.20 a yd. so that I can fall 10% from the marked price and yet make a profit of 20%. [Questions of teaching youth bad ethics.]

Milk is worth 20 cents a gallon, but by watering it the value is reduced to 15 cents a gallon.

If a boy idles away 1/4 hour a day, how much time will he lose in a year?

A lost at play 50% of his money the first game, 50% of the remainder the 2nd, and so on for 10 successive games when he was reduced to his last dollar; what had he at first?

A merchant uses a yardstick 1 inch short. He sells 50 yd. of carpet, as measured by this stick. How many true yards does his purchaser get?

If fine milk is reduced in value from 24 cents per gallon to 20 cents per gallon by the addition of water, how many quarts of water have been placed in a can that contains 40 qts. of the adulterated article?

School is in session 5 hours a day. How much time is a boy in school on Monday if he comes 1¼ hours late in the morning and ½ hour late in the afternoon?

A young man with an income of $600 yearly, smokes 3 cigars a day, which he buys at the rate of 3 for a quarter. [At least it is very wasteful—$91.25 a year out of $600.]

Religion—

In a church-going generation such as that in 1881 to 1910, it might be expected that religion and church affairs would figure largely in the arithmetic problems of the period. But such is not the case. Examples of this kind are few in every book of the series. There is evident here a failure to relate subject matter to the weekly experiences of children.

A S.S. collection in dimes, nickels, and cents amounts to 200 cents.

There are CL Psalms. When you have read XC, how many more have you to read?

The salary of a clergyman is $1,800 per year, and his yearly expenses are $1,450.

A Sunday School wishes to buy an organ which costs $125. The treasurer has $75.08. [This same problem was in another book—Series 49.]

After X persons were seated in a church 4 times as many more came in. . . .

Johnson gave $30 for the missionary cause and $25 to the tract society.

The number of Christians in the world is Roman Catholics 201,000,000; Protestants 106,000,000; Eastern Churches 81,000,000.

A church is lighted by 8 lamps—4 burners each.

I live 10 blocks from the church.

Science—

Many interesting problems are constructed out of the facts of science. Some are impractical from the standpoint of mere utility. But the problems found in this field are, generally speaking, informing and contribute to the fund of cultural knowledge considered necessary by the people of that period. Much more material might have been drawn from this field.

If the moon is 240,000 miles from the earth and the sun 92,000,000 miles; how much farther to the sun than to the moon?

The greatest depth of water yet measured is 29,400 ft. and the greatest height to which a balloon has ascended is 37,000 ft.

If average velocity of a bullet is 1,342 feet a second and that of sound 1,122 feet a second, how much time elapses, on a range of 3,000 feet, between the time the bullet strikes and the time the sound reaches the target?

If a comet moves 5° in 15 hours, how far in 5 days?

A cubic foot of water when frozen makes 1.089 cu. ft. of ice.

Friction matches were first used in this country in 1829. 9 years previous, illuminating gas was introduced.

The boiling point is how many degrees above the freezing point?

The specific gravity of atmospheric air compared with water is .0012. Of common gas .45 as compared with air.

Given that pure water contains 15 parts by weight of oxygen and 2 parts of hydrogen, what part of the weight of a gal. of water is hydrogen?

Sugar being composed of 49.856% oxygen, 43.265% carbon, and the remainder hydrogen. . . .

Social life—

If the social life of this period was restricted to the items mentioned in the arithmetic texts it must have been a narrow life indeed. The "good old times" do not appear in the subject matter of problems. "Husking bees," "sugar maple time" parties, "coming out parties," sleighrides, square dances, etc., quite common during this period, are not mentioned. Another fruitful field of problem subjects is thus practically ignored. The samples here given are representative of the kind of problems found.

A party of 6 hired a coach. If there had been 2 more, the expense would have been $1 less for each.

If there were 20 children at a party and 2 went home, how many were left?

Mary made a visit of 17 days. Then her mother allowed her to stay a week longer.

There were 144 people at a festival; 1/3 of them were men, 1/2 of them women.

60 persons were invited to a party and 50 of them came.

Eighty children attend a strawberry festival; each one eats half a pint of ice-cream.

Twenty-four ladies and 18 gentlemen went on an excursion, and their expenses, which were $1.50 each, were paid by the gentlemen.

There are 12 girls in a circle of King's Daughters. How many yards of ribbon to supply them 6 in. badges?

Cousin Fred came to our house on Monday and stayed 2 weeks. On what day did he start home?

Mr. and Mrs. Shaw and two children took a trip on a lake steamer. The fare was $9.00, children half price. Meals on the steamer were $1.00 each.

Sports—

Little interest in sports on the part of textbook writers is reflected in the problems of this period. Here, if anywhere, one might expect to find a close tie-up of problem subjects and children's interests. But the search for problems about sports is very poorly rewarded. A few were found, however, though their range is limited.

Dick caught 80 fish in a week and Tom caught 16.

If the diamond of a baseball field is a square 90 ft. on a side, how far directly from first to third?

In a jumping match Thomas jumped 3 ft. and his brother jumped 2 3/12 ft.

James has 24 marbles. He has 2/3 as many as John.

There are 8 oarsmen in a boat. Their combined weight is 1,088 lb.

A boy hires a boat at 20 cents per hour. How much has he to pay if he uses it from 20 minutes before 9 A.M. until 10 minutes past 1 P.M.?

Two boys go fishing; one brings 7 cakes for lunch, the other brings 5 cakes. A third boy joins them at noon and pays 12 cents for his share of the dinner.

The area of a chessboard marked in 8 rows of 8 squares each is 100 sq. in.

A race course was 30 knots. The time of the winning yacht was 3 hours 25 minutes.

Our tennis court is just 6/5 what it was originally, and it is now 120 ft.

Travel—

Methods of transportation, distances traveled, cost of travel are subjects touched upon in problems of this period. A few mentions of the automobile show that this means of transportation was coming into use. . Samples in this field are also rather few.

In the book "Around the World in 80 Days," a gentleman is said to have started from London and traveled constantly east. Before he reached London again he had seen the sun rise 81 times, and thought therefore he had been gone 81 days. How long had he been gone?

The railway company offered excursion tickets to Niagara Falls and return at $5 each.

In a journey of 1560 miles, Mr. D. traveled 195 miles by stage, and the rest of the distance by rail.

A man starting out on a journey took $200. He paid for R.R. fare $67, for berth in sleeping car 4 days $2.00; for hotel bills 15 days $3 a day; and for other expenses $25.

If 23 passengers travel by coach and 7 are seated on top, how many inside?

A man of means spent 1/3 of his life traveling in America, 1/4 of it in Europe, and the rest of it at his home.

A car loaded with steel rails 32 feet long.

The standard Florida orange box for shipping is 12 x 12 x 26 5/8 in.

California apples and pears for local use are shipped in a 50 lb. box 22 in. by 10 by 12.

At the rate of a mile in 4 minutes, how far will an automobile go in 3 hours?

Practicality of the written problems—In the survey of the opinions expressed by the different authors of this period on various problems of content and methods, it has been found that most of the writers insist that the problems used in arithmetics should, by all means, be practical; and, further, almost everyone insists that his book is notable in the rare virtue of utility. In a further analysis of the books, therefore, it should be ascertained whether the authors held to this ideal.

It is necessary first to ask just what is meant by the term "practical." There are at least two important phases of the term. First, in relation to problem content, "Is the problem useful from the standpoint of providing proper drill or exercise in the learning and performance of mathematical processes?" There is the possibility that a problem may be useful in developing skill in the handling of processes and yet not be true to fact or true to life. The author of an arithmetic might well ask, "Why should I be confined to facts any more than the poet or novelist or other writers?"

The second meaning of the term "practical" has to do with whether a problem deals with actualities; whether it is true to the actual facts of life; whether it meets the needs of pupils by presenting material with which pupils are familiar or with which they will actually have to deal, or whether it presents information which is immediately useful or which will be useful at a later date.

It would seem from a study of the authors' statements that they believed their books to be practical according to the criterion of being true to life and to facts.

A careful analysis of all the problems in the 13 sets of books brings many things to light in regard to the authors' success in presenting practical problems. Taking the books in order, it is possible to note a number of respects in which the problems fail to measure up to the standards set by the authors themselves.

In the first book of the series, White's *New Elementary Arithmetic*, page 185, is found a note in regard to measuring grain. "The standard bushel is 18½ in. in diameter by 8 in. deep, 2,150 2/5 cu. in.; in measuring corn in the ear, potatoes, apples, the measure must be *heaping* full." But a bushel of corn in the ear measures 3,888 cubic inches. A bushel measure of 2,150 2/5 cubic inches could not be *heaped* so as to hold 3,888 cubic inches. On page 205 is found a very improbable statement: "The four quarters of an ox weighed 284, 276, 301, and 298 lbs.," a total of 1,159 lbs. Since, in butchering, a beef animal usually loses 50 per cent, the ox must have weighed over 2,300 lbs. on foot. On page 98, "A canal boat was loaded with 245 bales of hay weighing 280 lbs. each." This is altogether out of line with farm practice. The first of these examples is utterly impossible, the other two altogether improbable.

In the Indiana Educational series there are found several improbable problems; for example, "A carpenter alone can build a house in 25 days, but with the assistance of his son he can build it in 15 days." What kind of house? The problem seems impossible.

"If one bale of hay weighs 5 cwt. 25 lbs. . . . " is another such problem. It would be impractical to handle such bales.

As a sample of the ridiculous, a problem on page 51 states: "A certain field contains 4,238 rows of corn." That would mean a field at least 2½ miles wide. Another of the same type is found on page 272. "Three men build a fence 40 rods long, 4 rails high in 2 days." This would mean 6 2/3 rods for each man, per day of 8 hours, or approximately 50 rails per day. That amount could easily have been built in from one to two hours. There were, commonly, no four rail fences built. The problem therefore is untrue to farm practice or to farm labor.

On page 280 the author says, "Corn having lost 16 2/3 per cent in weight." But corn doesn't lose 16 2/3 per cent. That would be 8 pounds to the bushel, over double the loss figured for early husked corn.

Another, from the Indiana Educational series: "A man had a garden 420 yards square [1,260 feet square]. He enlarged it to 4 times its size [2,520 feet square]." This is approximately ½ mile square, or 160 acres!

"If a bin 9 ft. long, 6 ft. wide, and 9 ft. deep holds 320 bu. of wheat, how many bushels will a bin hold that is 15 ft. long, 8 ft. wide, and 12 ft. deep?" But a bin of 9 x 6 x 9 holds 388.8 bushels according to the author's own rule, on page 184, of counting 4/5 bushels to a cubic foot. The large bin holds 1,152 bushels instead of 948 4/27, the answer given in the book. As a problem in proportion, the answer given is correct if one grants that a bin 9 x 6 x 9 holds 320 bushels. The problem is based on an inaccuracy.

In the same book is found: "If 8 men plough 12 acres in 9 days,

how many men can plow 8 acres in 12 days?" Eight men should plough the 12 acres in one day, or even with oxen in two days at most. The problem is ridiculous from the farm-practice standpoint.

In Milne (39) several impractical and improbable problems are found. On page 164, "The railroad fare between two places was $6 37/50." Quite impractical when making change! The following problem is found on page 169:

"What part of 4 3/5 is $\frac{3.5}{12\ 8/9} \times \frac{6\ 2/3 - 4\ 1/4}{1/2 \times 4\ 5/6}$?"

In what life situation would such a problem be presented?

On page 143, Milne speaks of a cistern holding 280 gallons. That would figure 3 x 3 x 4 feet, "and the supply pipe can fill it in 10 hrs." An improbable problem!

This problem is also found in Milne: "Having a garden 324 yards square, he enlarged it so as to make it 9 times as large. How many square yards was it then?" At 324 yards square the man had a garden of 21.7 acres. Nine times that size make it a garden of 195.3 acres.

Is the following problem practical? "Three men bought a grindstone 20 inches in diameter. How much of the diameter must each grind off so as to share the stone equally, making no allowance for the eye?"

Southworth (40) does not furnish many examples of the impossible and impractical problems. However, a few illustrations are found; for example, on page 105, "Mr. —— hauls 78 loads of earth, 18 of sand, 105 of brick, at $0.27 a load." This is a ridiculously low price, altogether untrue to facts.

The following problem is impractical from the farm-practice viewpoint. "In a fence 573 ft. long the fence posts were 1 ft. through." Fence posts one foot through, except for corner posts, would be rather ridiculous.

Walsh (41) provides a few samples of the improbable or incorrect type of problems. "If it takes 10½ yards for the skirt of a dress, and 3½ yards for the waist, how many yards in all?" Fourteen yards!

On page 208 is found "A butcher buys an ox weighing 1,200 lbs. at 6c. When dressed it weighs 2/3 of live weight." This is not true to fact, for if a beef dresses out 55 to 60 per cent it is considered extra good.

Also on page 315: "A lot 25 ft. by 100 ft. has a house on it 25 ft. by 55 ft. How many sq. ft. left for a yard?" But a man would not be permitted to put a house 25 feet wide on a 25-foot lot, because the eaves would project over the two adjoining lots.

"A gardener furnished 3 rose bushes, 4 grapevines, 11 fuchsias, and 25 pansies. He charged for 2 3/4 days labor." This work could have been done easily in the 3/4 of a day. The labor time is all out of proportion.

On page 431, "A man sold a wagon for $420 which was 16% less than cost." The cost, therefore, was $500. But wagons didn't sell at $500 in those days. This is not true to facts. Another sample entirely out of line with farm practices and prices is the following: "A

farmer wishes to construct a rail and post fence around a square field of 40 acres. Posts are 15c, 8½ ft. apart; rails 10c, five rails high." This would mean that the cost of material alone would figure $208 or $1.30 per rod. This cost would be prohibitive and is not true to farm life.

A good sample from McClellan and Ames (42) of the absurd type of problems is the following, page 193: "If a half peck of potatoes is obtained from each hill on the average, what is the yield in bushels?" According to the usual manner of planting potatoes, this figures out over 1,600 bushels per acre! On page 195 of this book appears the question, "How many bushels of potatoes from a garden with 160 rows, 240 hills to a row, 10 potatoes to a hill, if 6 potatoes equal 3 pints?" This would mean a yield for the garden of over 3,000 bushels. The problem is not true to yields of potatoes in America.

McClellan and Ames, page 190, speak of a "trotting horse with a stride of 16 feet." Is that true to life? And also, "If 16 horses can plow 1,280 acres in 8 days, how many acres can 12 horses plow in 5 days?" That would mean that eight teams could plow 160 acres a day, and that one team could plow 20 acres a day. But two acres a day is a good day's work for a team. Ten times that is too much!

One further example from McClellan and Ames: "If 36 men, working 16 days, can dig a trench 72 yards long, 18 yards wide, and 12 yards deep, etc." What is a trench? The dimensions given describe a hole 216 feet long, 54 feet wide, and 36 feet deep! How could a man remove the dirt to a depth of 36 feet, at the rate of 27 cubic yards a day? The problem is ridiculous.

In the next set of books, the Indiana Schoolbook series (43), a number of most impractical problems are included; some are improbable, others absurd, while others are not in accord with practices of the time. Three of these have to do with the amount of work men do in a day. One problem states that "20 men build 240 rod of fence in 24 days of 9 1/3 hours each." But what kind of fence would require 9 1/3 hours in which to build ½ rod? This is not true to life. Another states that "a mason will lay 1,800 bricks a day." That would be an unreasonable number for a day's work. A third problem states that a teamster hauled 37,359 bricks at 21 loads—less than 1,800 per load. But on page 105 he has said "each load contains 7,389 bricks," and on page 89, "a teamster hauled 10 loads of brick containing 17,693, 11,469," etc. Would not the student be bewildered as to what an ordinary load of bricks should be? To the farm boy or teamster's son would not such problems seem absurd?

Woodward (44) goes far outside ordinary experiences when he tells in one problem of a man's buying four horses, paying $3,985, $5,025, $2,789, and $6,898. And in another the price paid was $15,284. These prices would be ridiculous unless the horses were imported registered stock, about which most boys in the grades would know nothing.

On page 123, "A gallon contains 231 cu. in.; a bushel 2,150.42 cu. in. A gallon is what decimal of a bushel?" But a gallon of 231 cubic inches is liquid measure, while a bushel of 2,150.42 cubic inches is dry measure. The problem is wrong and confusing.

According to page 106, "A butcher had five fat oxen . . . the fifth weighed 2,525 lbs." It is quite doubtful whether there were any oxen in 1899 that weighed 2,525 pounds.

Page 168 of Woodward's advanced book contains the problem, "If a horse consumes 4 1/6 tons of hay in five months. . . ." That would be at the rate of 10 tons a year, which is two to three times what a horse eats.

There are many absurd problems in Woodward's advanced book, many more than we can cite here. The two following problems are good samples: "A built a house using 768,453 red brick and 253,472 yellow brick." What a house that would be; for 1,021,925 bricks would be sufficient for 12 houses, 18 feet high, with 60 x 40 foot foundations! Most ridiculous!

"How long should a corn crib be which is to hold 200 bu. and is 16 ft. wide and 12 ft. high?" It wouldn't be *long* at all, for the third dimension would be only 2½ feet. The crib would be ridiculous in dimensions.

Hornbrook's series (45), though it does not have so many absurd problems as some of the other books analyzed, nevertheless has some that are quite outstanding. For example: "A family started in a wagon to St. Louis, 132 miles away. They rode 24 miles a day for 5 days. They started on the 6th day at nine o'clock to drive at 6 miles an hour the rest of the way. At what time did they reach St. Louis?" The problem is ridiculous in that the family traveled only 24 miles per day (two to three miles per hour) and then on the last day ran the horses unmercifully at six miles per hour for two hours!

Hornbrook's knowledge of farm practice and farm life was evidently quite limited for her problems in that field are often absurd. For example, page 223: "Forty per cent of a load of hay was clover. If one ton was clover, what was the weight of the load?" Answer, 2½ tons. But there were no large trucks in those days and one couldn't put 2½ tons on a wagon.

On page 273 is found "A farmer had a field 21 rods square. Three rows of wire fencing were put around it." What is meant by three rows? Three lines of fence, or three wires? In the next problem, "1/3 of the fence was blown down." But wire fences don't blow down! All these problems are not true to farm life.

A most absurd problem is given by Hornbrook in this one: "A certain freight car contains 24,000 cu. ft. of space." On what railroad did they use it? It would be 100 feet long, 24 feet wide, and 10 feet high from floor to roof!

The Johnson series (46) includes several absurd problems and several samples of inaccuracy, though the authors make the claim that "many of the problems have the rare virtue of everyday utility. There are no absurd premises. The facts and figures are from authoritative sources."

The following is a sample of inaccuracy: "Mt. Blanc is 15,572 ft. high and is 3,572 ft. higher than Pike's Peak." But Pike's Peak is 14,108 feet high, not 12,000!

The following also: On page 394, a cubic yard of granite weighs

4,700 pounds. On page 407, a block of granite 10 x 5 x 1 1/3 feet or 66 2/3 cubic feet weighs only 5,200 pounds. According to his own statement of 4,700 pounds per cubic yard, the block of granite should weigh 11,609 pounds.

On this same page (407), a premise is given: "If 10 men can cut 46 cords of wood in 18 days, working 10 hours a day." This figures just one cord a man for nearly four days of ten hours each! This is out of line with facts, for one man could cut two to three cords a day.

Another false premise is found on the same page: "A miller has a bin 9 ft. long, 4 ft. wide, and 2 ft. deep holding 72 bu. of wheat." But this bin can hold only 57.6 bushels of wheat.

In Southworth and Stone (47) there are few problems that are ridiculous or contain inaccurate statements. One, page 252, speaks of three "rows" of wire in a fence, showing an unfamiliarity with farm terminology. Another problem gives the dimensions of a cistern as 13 3/8 feet by 6 feet by X, having 294½ cubic feet. X then = 3 3/4 feet, which is absurdly out of proportion. In still another problem they say, "It requires 375,000 bricks for a house." That number of bricks would build five to six big two-story houses and is therefore not true to the facts of ordinary construction.

In Smith's *Primary Arithmetic* (48) no glaring inconsistencies or absurdities are found. But in the advanced book several appear; for example: "At 21c a foot what would it require to inclose a farm 150 rod by 160 rod with a wire fence?" The cost per rod would be $3.465, which is altogether out of line with farm fence prices, then or now.

On page 26 a picture is shown of a binder at work; a *self binder*. But the bundles of wheat, as shown, are tied with straw, by hand! A serious blunder from the country boy's viewpoint.

A rather ridiculous problem is found on page 165. "If a homing pigeon makes a flight of 1,270 miles in 13 days 5½ hours, what is the average speed per hour?" If the pigeon spent 13 days going 1,270 miles, that would be only 100 miles per day, or 10 miles per hour for 10 hours. This is quite untrue to ways of homing pigeons!

Several problems show Smith's lack of knowledge of farm practices. For example: "A farmer puts 5 acres into celery, setting out 20,000 plants to the acre, the yield being 1500 doz. heads to the acre." Celery, however, is not sold by the head, but by the bunch. It has no head! Another sample: "A farmer paid the following amounts for a 50 acre wheat field: Plowing, 9 da. @ $2.75." This is less than 50c per acre, a price altogether ridiculous even in the worst times!

On page 389, Smith says, "If a gallon of water weighs 10 lbs." But it doesn't; it weighs only 8.35 pounds.

Cook and Cropsey (49), the last of the series of 13 sets of arithmetics, is remarkably free from absurdities, though several problems are somewhat inaccurate or not in line with common practice. For example, page 32: "How many men are needed to carry it [the sill], each man being able to lift 232 lbs." The men would need to be better than the ordinary. Another sample is found on page 143:

"After traveling, a man found his watch 1 hour 24 minutes faster than the local time." How would he compute this? All local time was standard. The watch would be either one hour or two hours fast.

On page 293 another one appears: "If iron weighs 450 lbs. to the cubic foot, what will be the weight of an iron ball 3 ft. in diameter?" This weight is far from the 491 lbs. given as the weight per cubic foot by Webster's *New International Dictionary*.

The samples of problems given in the preceding pages show quite conclusively that all of the 13 authors whose books we have analyzed have failed in some instances to meet the standard of practicality and factual accuracy. Some are found to be much more at fault in this respect than others.

It will be noted that most of the absurd, impossible, and inaccurate problems are found in the very fields in which the ordinary upper grade pupils would be familiar and able to check up on inaccuracies and errors. For example: 28 of the 58 problems cited are taken from farm life. With this field, no doubt, a large majority of the pupils of this period would be rather fully acquainted, and would be able to note problems that were out of line with facts and practices.

The second largest group of absurd problems noted are in the field of weights and measures. Ten problems are found in this field. This is another sphere in which most of the pupils of the period would be working with things quite familiar to them.

The labor field is next with six problems. The rest of the problems cited are scattered over nine different fields, practically all of which came within the experience of elementary pupils.

The fact that most of the ridiculous and inaccurate problems were found in the practical everyday fields, farm life, weights and measures, and labor, may indicate that the authors were professional men who were not familiar with facts in these more lowly fields of human endeavor.

The above rather formidable array of undesirable problems may seem to reflect seriously upon the carefulness and wisdom of the 13 authors. In extenuation it may be noted that the average number in each book is not high, and also that few writers in any field reach the ideals they themselves set up.

SUMMARY AND CONCLUSIONS

The texts used in this analysis are, with few exceptions, notably uniform in size, binding, and type. Only the two earlier sets are bound in leather. Two sets have longer lines and larger type than the others. The 13 sets are uniform also in having two books each, one for the primary grades and the other for the more advanced grades.

The prefaces and introductions are interesting and informative. They are indicative of the purposes of the writers and of the attitudes they had toward problems of methods and problems of practicality of material. Most of the writers claim for their books originality, a good arrangement of material, a good choice of material, and, especially, a wise selection of practical problems.

All authors shy away from an extreme use of either the logical or the spiral method of procedure.

The changes from customary practice made by these authors in the fields of methods, arrangement of topics, and general content were very minor, except in a few cases. There is no change made that could be called revolutionary, nor is there any notable contribution of new methods or material.

Most of the authors felt a definite need for improved books—and express the hope that their books will help meet the nneed.

The chief subjects about which there seems to have been a difference of opinion are: the use of objects, the use of pictures, the logical and psychological methods, the arrangement of content, and the essential content.

One way to see the sources from which most of the problem material was drawn and also the comparative amounts of material used from these sources is by noting that when ranked 1, 2, or 3, according to frequency of use, the following 22 different fields of subject matter stand as follows:

Rank 1—agriculture	foods
business	history
dress	science
Rank 2—education and schools	interesting items
industry	living expenses
Rank 3—children's occupations	military affairs
health and sanitation	morals
home economics	religion and church
human relations	social life
insurance	sports
labor	travel

It will be noted that several very fruitful fields were used but little. In fact all subjects ranked "3" could have been used much more extensively because they were, except in one or two cases, of common interest.

Many sample problems show conclusively that all of the 13 authors failed in some cases to make their written problems practical and factual. Some authors are much more at fault in this respect than are others.

Most of the absurd or inaccurate problems are found in familiar fields. Out of a total of 58 such problems, 28 are from farm life, 10 are from the field of weights and measures, and 6 are from the labor field.

The number of 400-word pages found in the 13 different series varies from 581 in the Indiana Schoolbook series to 895 in Southworth and Stone. The extra space in Southworth and Stone is given chiefly to a much fuller treatment of a few subjects.

The subjects treated by all authors combined fall under 32 major classifications and 44 subdivisions (shown in Tables I and II).

Certain major classifications found in the preceding period (1851-

1880) are not found in this one. For example: barter; tare, trett, and cloff; mechanics; and building association business.

Some new classifications appear: stocks, properties of numbers, the metric system, and cancellation.

The "Big Ten" of the 32 subjects treated are given 7,991 pages out of the total of 9,272 contained in all books combined—or 86 per cent. These subjects are all treated in at least 12 of the 13 sets.

Thirteen of the 32 major classifications are treated in all sets of books. Two are included by only one author, two by just two authors, and two by only three authors.

Certain subjects of great importance in practical business life are given only a small amount of space. For example: bonds, federal money, stocks, taxes, and bills and accounts.

Wide differences are found in the amount of space given by different authors to the various subjects. For illustration take the percentages of total space given by different books to a few of the major subjects, and note the range: denominate numbers .73 to 10.63; decimals, 2.42 to 6.41; fractions, 6.02 to 15.26; fundamental processes, 17.95 to 36.81; percentage, 6.72 to 17.73; and miscellaneous problems, 1.69 to 14.78.

In only one case is there found complete unanimity of opinion as to the relative importance of a subject. All authors agree that fundamental processes should have more space than any other subject.

Only three subjects are allotted more than 1,000 pages in all books combined. These are fundamental processes, percentage, and fractions.

Wide differences are noted in the per cent of space given by different authors to the different types of content and procedure. In definitions and explanations the range is from 1.69 to 9.80; in rules and explanations, from .01 to 5.69; in drill problems, from 15.05 to 45.37; and in written problems, from 10.41 to 32.43.

Not a single trend is noted in increasing or decreasing the per cent of space given to different types of content or procedure.

To rules, tables, definitions, questions, notes to teachers, etc., combined, is given about 90 per cent as much space as is given to all the fundamental processes. That is, almost as much space is given to the mechanics of instruction as is given to the most important subject treated.

In the field of problem subjects there is evident a tendency to select a few favorite words and to use them over and over again. One author has 87 problems about horses, and another has 85. Two authors include 92 problems each about houses. One has 90 about the merchant, another 78 about tea.

In the problem-subject field, also, is noted a tendency to use generic terms over and over again instead of naming some definite varieties. For example, corn, apples, etc., are often used—but no specific kinds are mentioned.

No particular effort is noticeable to use in problems the articles of food, or toys, or games, or in fact many other things in which children naturally take greatest interest and delight.

A few words show a definite decrease in frequency of mention as problem subjects, while others show a decided increase. Examples are pointed out in the analysis.

The most noteworthy tendency in the use of problem subjects is the increased frequency of mention of all words having to do with education.

Very few words which were used as problem subjects in the 1881 to 1910 period are obsolete today.

Of the 13 authors, Southworth (40) shows the largest vocabulary —with 898 different problem subjects. Walsh (41) uses the smallest number of problem subjects—with 400—but he also uses the smallest number of pages of written problems.

Since some books contain many more pages of written problems than do others, a truer comparison of the number of problem subjects in each book would probably be that of the number of subjects per page of written problems. This varies from 2.17 in the Southworth-Stone series to 9.59 in the Woodward series. While the first four books contain an average of four subjects to the page of written problems, the last four contain only three plus. Of the other five books, those published in the three years from 1898 to 1900, three contain more problem subjects per page of written problems than do any of the other books, and the other two are among the three books containing the fewest. Thus it can be seen that no trends can be pointed out in this respect.

On the whole, a necessary conclusion from the analysis of the 13 sets of arithmetics is that in the 30-year period, 1881 to 1910, the writing of arithmetic texts made no definite noteworthy advance. However, certain minor commendable changes were made, for example by Smith, who presents problems centered around certain industries which were of interest in his day.

A List of Bulletins in the Field of Education, Indiana University

By Kathleen Dugdale

The School of Education at Indiana University has published the following bulletins. All of these may be obtained from the University Bookstore for 50 cents postpaid unless otherwise noted.

Proceedings of the High School Principals' Conference (November 23 and 24, 1923). Vol. I, No. 1, 1924. 85 p. (Supply exhausted.)

Investigation of Nursing as a Professional Opportunity for Girls, Part I, Technical Study; Part II, Vocational Information Bulletin. By Florence E. Blazier. Vol. I, No. 2, 1924. 69 p.

Proceedings of the Eleventh Conference on Educational Measurements. Vol. I, No. 3, 1925. 141 p.

Proceedings of the High School Principals' Conference (November 14 and 15, 1924). Vol. I, No. 4, 1925. 49 p. (Supply exhausted.)

First Revision of the Bibliography of Educational Measurements. Compiled by the Bureau of Cooperative Research. Vol. I, No. 5, 1925. 147 p. (Supply exhausted.)

Proceedings of the Twelfth Conference on Educational Measurements. Vol. I, No. 6, 1925. 76 p.

The Effect of Population upon Ability to Support Education. By Harold F. Clark. Vol. II, No. 1, 1925. 28 p.

Proceedings of the High School Principals' Conference (November 20 and 21, 1925). Vol. II, No. 2, 1925. 77 p. (Supply exhausted.)

A Cross-Indexed Bibliography on School Budgets. By Harold F. Clark. Vol. II, No. 3, 1926. 66 p.

A Comparison of the Results Made on Certain Standardized Tests by Pupils in the Bloomington High School Who Were Taught in Classes of the Same Grade by University Student Teachers and by Regular High School Teachers. By Carl G. F. Franzén. Vol. II, No. 4, 1926. 19 p.

Proceedings of the Thirteenth Annual Conference on Educational Measurements. Vol. II, No. 5, 1926. 103 p.

When to Issue School Bonds. By Harold Florian Clark and Paul Royalty. Vol. II, No. 6, 1926. 16 p.

Students' Attitude Toward Examinations. By Grover T. Somers. Vol. III, No. 1, 1926. 48 p.

Proceedings of the High School Principals' Conference (November 12 and 13, 1926). Vol. III, No. 2, 1926. 27 p.

Index Numbers in School Administration. By Harold F. Clark. Vol. III, No. 3, 1927. 35 p.

Topical Analysis of 234 School Surveys. Compiled by the Bureau of Cooperative Research. Vol. III, No. 4, 1927. 111 p. (Supply exhausted.)

Proceedings of the Fourth Annual Conference on Elementary Supervision. Vol. III, No. 5, 1927. 64 p.

Proceedings of the Fourteenth Annual Conference on Educational Measurements. Vol. III, No. 6, 1927. 66 p.

Some Phases of the Junior College Movement. By I. Owen Foster, Harold F. Clark, Willard W. Patty, and Leo M. Chamberlain. Vol. IV, No. 1, 1927. 125 p. (Supply exhausted.)

Second Revision of the Bibliography of Educational Measurements. By Henry Lester Smith and Wendell William Wright. Vol. IV, No. 2, 1927. 251 p. (75¢)

Bibliography of School Buildings, Grounds, and Equipment, Part I. By Henry Lester Smith and Leo Martin Chamberlain. Vol. IV, No. 3, 1928. 326 p. (75¢)

Proceedings of the High School Principals' Conference (November 18 and 19, 1927). Vol. IV, No. 4, 1928. 54 p.

The Economic Effects of Education. By Harold F. Clark. Vol. IV, No. 5, 1928. 39 p.

Proceedings of the Fifteenth Annual Conference on Educational Measurements. Vol. IV, No. 6, 1928. 73 p.

Proceedings of the Fifth Annual Conference on Elementary Supervision. Vol. V, No. 1, 1928. 54 p.

Proceedings of the High School Principals' Conference (November 16 and 17, 1928). Vol. V, No. 2, 1928. 33 p.

The Development and Use of a Composite Achievement Test. By Wendell William Wright. Vol. V, No. 3, 1929. 90 p.

An Analysis of the Attitudes of American Educators and Others Toward a Program of Education for World Friendship and Understanding. By Henry Lester Smith and Leo Martin Chamberlain. Vol. V, No. 4, 1929. 109 p.

Tentative Program for Teaching World Friendship and Understanding in Teacher Training Institutions and in Public Schools for Children Who Range from Six to Fourteen Years of Age. By Henry Lester Smith and Sherman Gideon Crayton. Vol. V, No. 5, 1929. 54 p.

Proceedings of the Sixteenth Annual Conference on Educational Measurements. Vol. V, No. 6, 1929. 96 p.

Proceedings of the Sixth Annual Conference on Elementary Supervision. Vol. VI, No. 1, 1929. 73 p.

An Analysis of the Duties of County School Superintendents and Superintendents of Schools in Certain Cities in Indiana. By Henry Lester Smith and Leo Martin Chamberlain. Vol. VI, No. 2, 1929. 94 p.

Proceedings of the High School Principals' Conference (November 22 and 23, 1929). Vol. VI, No. 3, 1930. 51 p.

Cooperative Studies in Secondary Education. By Henry Lester Smith and Carl G. F. Franzén. Vol. VI, No. 4, 1930. 121 p.

Proceedings of the Seventeenth Annual Conference on Educational Measurements. Vol. VI, No. 5, 1930. 103 p.

Proceedings of the Seventh Annual Conference on Elementary Supervision. Vol. VI, No. 6, 1930. 102 p.

A Study in Teacher Supply and Demand in Indiana. By I. Owen Foster, Robert K. Devricks, Harry N. Fitch, Earl C. Bowman, and George L. Roberts. Vol. VII, No. 1, 1930. 77 p.

Proceedings of the High School Principals' Conference (November 7 and 8, 1930). Vol. VII, No. 2, 1930. 70 p.

The Philosophy of Human Relations: Individual and Collective—A Source Book. By Henry Lester Smith and Harold Littell. Vol. VII, No. 3, 1931. 326 p. (75¢)

The Psychology of Human Relationships: Individual and Social—A Source Book. By Henry Lester Smith and Levi McKinley Krueger. Vol. VII, No. 4, 1931. 107 p.

Proceedings of the Eighteenth Annual Conference on Educational Measurements. Vol. VII, No. 5, 1931. 83 p.

Efficiency in College Management. By John Dale Russell. Vol. VII, No. 6, 1931. 143 p.

Bibliography of School Surveys and of References on School Surveys. By Henry Lester Smith and Edgar Alvin O'Dell. Vol. VIII, Nos. 1 and 2, 1931. 212 p. (75¢)

Proceedings of the Nineteenth Annual Conference on Educational Measurements. Vol. IX, No. 1, 1932. 139 p.

Bibliography of School Buildings, Grounds, and Equipment—Part II. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. IX, No. 2, 1933. 182 p.

Bibliography of School Buildings, Grounds, and Equipment—Part III. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. IX, No. 3, 1933. 130 p.

A Brief Summary of Literature on Leadership. By Henry Lester Smith and Levi McKinley Krueger. Vol. IX, No. 4, 1933. 80 p.

Proceedings of the Twentieth Annual Conference on Educational Measurements. Vol. X, No. 1, 1933. 98 p.

Bibliography of College and University Buildings, Grounds, and Equipment. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. X, No. 2, 1934. 199 p. (75¢)

Factors Affecting the Organization of School Attendance Units. By Raleigh Warren Holmstedt. Vol. X, No. 3, 1934. 32 p.

The Old World Historical Background of Religious and Moral Education in Schools. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. X, No. 4, 1934. 144 p.

Proceedings of the Twenty-first Annual Conference on Educational Measurements. Vol. XI, No. 1, 1934. 96 p.

Bibliography of School Buildings, Grounds, and Equipment—Part IV. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. XI, No. 2, 1935. 216 p.

A Brief Survey of Present-Day Religious and Moral Education in the Schools of Countries Other Than the United States of America. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. XI, No. 3, 1935. 185 p.

Some Practical Efforts to Teach Good Will. By Henry Lester Smith and Peyton Henry Canary. Vol. XI, No. 4, 1935. 169 p.

Proceedings of the Twenty-second Annual Conference on Educational Measurements. Vol. XII, No. 1, 1935. 97 p.

A Basis for the Improvement of Education in Rural Monroe County, Indiana. By Henry Lester Smith and Forest Ruby Noffsinger. Vol. XII, No. 2, 1936. 168 p.

Reading Readiness—A Prognostic Study. By Wendell William Wright. Vol. XII, No. 3, 1936. 46 p.

Proceedings of the Twenty-third Annual Conference on Educational Measurements. Vol. XII, No. 4, 1936. 60 p.

Bibliography of Literature on the Teaching of English. By Henry Lester Smith and William Isaac Painter. Vol. XIII, No. 1, 1936. 299 p.

Bibliography of Literature on Education in Countries Other Than the United States of America. By Henry Lester Smith and William Isaac Painter. Vol. XIII, No. 2, 1937. 341 p. (75¢)

Character Development through Religious and Moral Education in the Public Schools of the United States. By Henry Lester Smith, Robert Stewart McElhinney, and George Renwick Steele. Vol. XIII, No. 3, 1937. 137 p.

Proceedings of the Twenty-fourth Annual Conference on Educational Measurements. Vol. XIII, No. 4, 1937. 100 p.

Bibliography of Literature on Education in Countries Other Than the United States of America (January 1, 1919, to December 31, 1934). By Henry Lester Smith and William Isaac Painter. Vol. XIV, No. 1, 1937. 139 p.

Two Studies in Education. By Henry Lester Smith and Merrill Thomas Eaton. Vol. XIV, No. 2, 1938. 42 p.

Bibliography of School Surveys and of References on School Surveys (Supplement to Vol. VIII, Nos. 1 and 2). By Henry Lester Smith and Edgar Alvin O'Dell. Vol. XIV, No. 3, 1938. 144 p. (75¢)

Proceedings of the Twenty-fifth Annual Conference on Educational Measurements. Vol. XIV, No. 4, 1938. 37 p.

Remedial Instruction in Reading with College Freshmen. By Nila Banton Smith. Vol. XV, No. 1, 1938. 35 p.

Two Studies in Arithmetic. By Henry Lester Smith and Merrill Thomas Eaton. Vol. XV, No. 2, 1939. 91 p.

The Relation of Retention to Speed of Learning. By Henry Lester Smith and Merrill T. Eaton. Vol. XV, No. 3, 1939. 105 p.

Proceedings of the Twenty-sixth Annual Conference on Educational Measurements. Vol. XV, No. 4, 1939. 53 p.

An Experimental Study of Standards for the Selection of Candidates for Teacher-Training Institutions. By Henry Lester Smith and Merrill Thomas Eaton. Vol. XVI, No. 1, 1939. 72 p.

State Control of Public School Finance. By Raleigh Warren Holmstedt. Vol. XVI, No. 2, 1940. 71 p.

Teacher Tenure in Indiana and the Courts. By Henry Lester Smith and R. Foster Scott. Vol. XVI, No. 3, 1940. 81 p.

Twenty-seventh Annual Conference on Educational Measurements. Vol. XVI, No. 4, 1940. 37 p.

A Study of the English Usage, Spelling, and Vocabulary of 251 Graduate Students at Indiana University. By Henry Lester Smith and Merrill T. Eaton. Vol. XVI No. 5, 1940. 71 p.

The Teaching of Arithmetic to Low-Ability Students in the Elementary Schools. By Henry Lester Smith and Merrill T. Eaton. Vol. XVI, No. 6, 1940. 130 p.

An Analysis of the Achievement of 164 Sophomores Enrolled in Teacher-Training Courses at Indiana University. By Henry Lester Smith and Merrill T. Eaton. Vol. XVII, No. 1, 1941. 31 p.

The Scholastic Achievement of Athletes at Indiana University. By Henry Lester Smith and Merrill T. Eaton. Vol. XVII, No. 2, 1941. 16 p.

Twenty-eighth Annual Conference on Educational Measurements. Vol. XVII, No. 3, 1941. 42 p.

Legal Relations of Pupils and Parents to the Public Schools of Indiana—Part I. By Henry Lester Smith and R. Foster Scott. Vol. XVII, No. 4, 1941. 81 p.

Legal Relations of Pupils and Parents to the Public Schools of Indiana—Part II. By Henry Lester Smith and R. Foster Scott. Vol. XVII, No. 5, 1941. 72 p.

A Study of Students Transferring from Indiana University. By Merrill T. Eaton. Vol. XVII, No. 6, 1941. 26 p.

An Analysis of Arithmetic Textbooks (First Period—1790-1880). By Henry Lester Smith and Merrill T. Eaton. Vol. XVIII, No. 1, 1942. 55 p.

Education in Guatemala. By Juan Espéndez-Navarro and Henry Lester Smith. Vol. XVIII, No 2, 1942. 96 p.

A Study of Indiana University Withdrawals. By Merrill Thomas Eaton. Vol. XVIII, No. 3, 1942. 20 p.

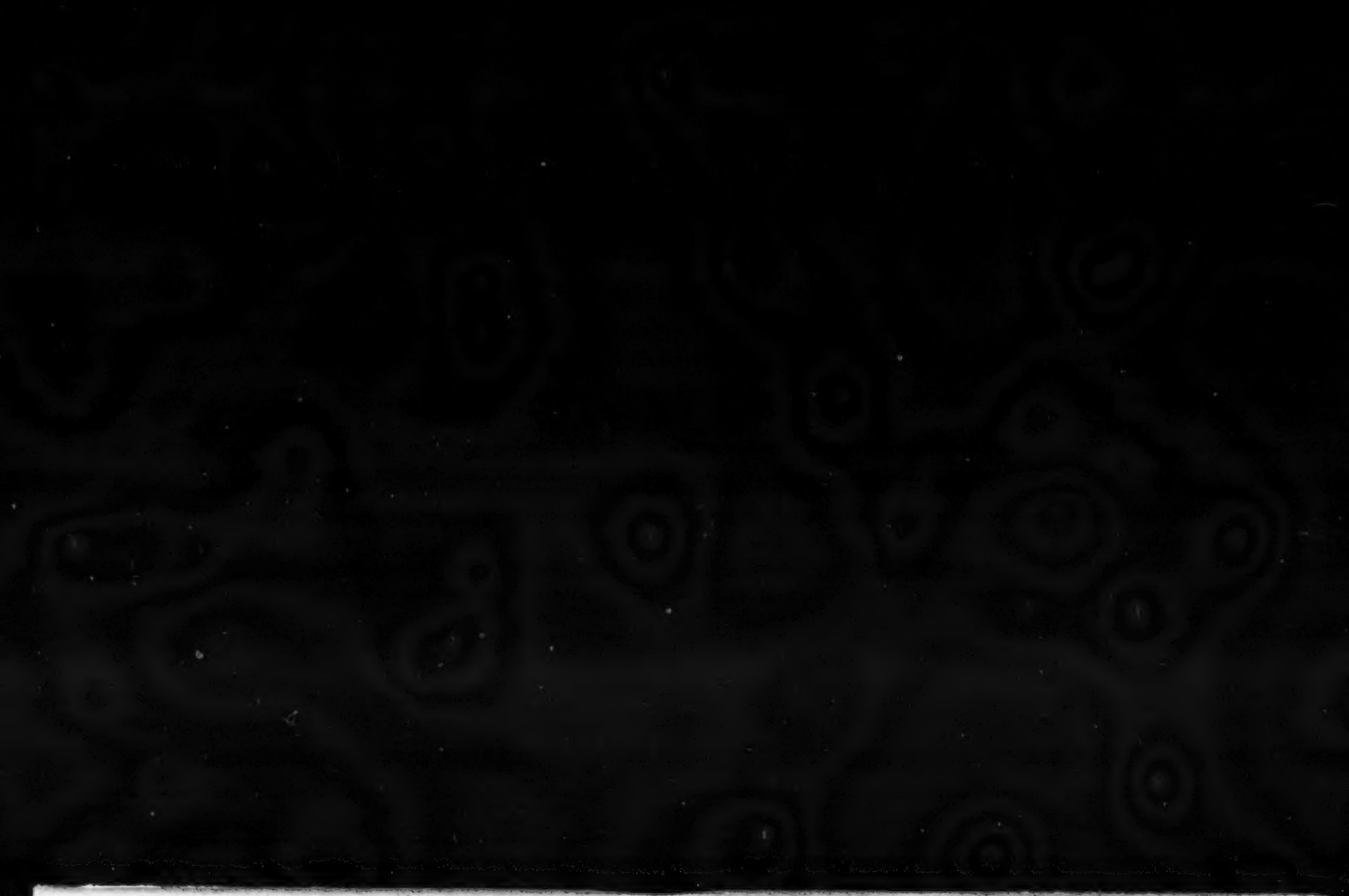
Education in Mexico. By Henry Lester Smith. Vol. XVIII, No. 4, 1942. 95 p.

Twenty-ninth Annual Conference on Educational Measurements, and *A Study of the Achievement of Freshman Students Holding County Scholarships.* By Merrill T. Eaton. Vol. XVIII, No. 5, 1942. 57 p.

An Analysis of Arithmetic Textbooks (Second Period—1821 to 1850, and Third Period—1851 to 1880). By Henry Lester Smith and Merrill Thomas Eaton. Vol. XVIII, No. 6, 1942. 112 p.

World War Information. By Margaret I. Rufsvold. Vol. XIX, No. 1, 1943. 129 p.

A Measure of Motor Fitness for College Men. By Karl W. Bookwalter and Carolyn W. Bookwalter. Vol. XIX, No. 2, 1943. 26 p.

A Study of Students Transferring to Indiana University from Other Colleges and Universities. By Merrill T. Eaton. Vol. XIX, No. 3, 1943. 39 p.

An Analysis of Arithmetic Textbooks (Fourth Period—1881 to 1910). By Henry Lester Smith and Merrill Thomas Eaton. Vol. XIX, No. 4, 1943. 62 p.